Status Quo and Potential of XBRL for Business and Information Systems Engineering

The eXtensible Business Reporting Language (XBRL) was recently mandated in the USA as the standard for electronic financial reporting. Since June 2009, the US Securities and Exchange Commission (SEC) has required all listed companies to provide their financial reports in XBRL. Similarly, from 2011 all German companies will be mandated to use XBRL in the context of reporting to tax authorities. The growing importance of XBRL is the motivation for this paper, exploring the progress of research conducted in the XBRL domain. The results of this study show that the majority of the 57 analyzed XBRL-related academic papers adopt an empirical research design, with researchers using methods such as descriptive statistical analyses, interviews, and case studies to analyze the international acceptance and adoption of XBRL as a financial reporting standard. The paper provides a comprehensive and structured overview of current XBRL research and delivers recommendations for future research topics for both the academic and practitioner communities. This paper also identifies the lack of an integrated, data-oriented, and technical approach in current global XBRL research which is necessary to meet the requirements of financial reporting in the future and to which Business and Information Systems Engineering (BISE) may contribute.

DOI 10.1007/s12599-011-0169-1

The Authors

Dipl.-Kfm. André Gräning (✉)
Faculty of Business and Economics
Technische Universität Dresden
Helmholtzstraße 10
01069 Dresden
Germany
andre.graening@tu-dresden.de

Prof. Dr. Carsten Felden
Faculty of Business Administration
Technische Universität
Bergakademie Freiberg
Lessingstraße 45
09599 Freiberg
Germany
carsten.felden@bwl.tu-freiberg.de

Dr. Maciej Piechocki
International Financial Reporting Standards (IFRS) Foundation
Cannon Street 30
EC4M 6XH London
United Kingdom
mpiechocki@ifrs.org

Received: 2010-01-04
Accepted: 2011-02-28
Accepted after four revisions by Prof. Dr. Peter Buxmann.
Published online: 2011-07-12

This article is also available in German in print and via http://www.wirtschaftsinformatik.de: Gräning A, Felden C, Piechocki M (2011) Status Quo und Potenziale der eXtensible Business Reporting Language für die Wirtschaftsinformatik. WIRTSCHAFTSINFORMATIK. doi: 10.1007/s11576-011-0282-2.

Electronic Supplementary Material
The online version of this article (doi: 10.1007/s12599-011-0169-1) contains supplementary material, which is available to authorized users.

The statements represent the author's M. Piechocki view and do not reflect the opinion of the IFRS Foundation.

1 Introduction

"…what if everyone would use one standard? What if you could turn a financial report into a database? What if a piece of business information, once entered into a computer anywhere, never needed to be retyped as it moved through the business supply chain?" (Kernan 2009, p. 4)

In the late 1990s, this idea was the stumbling block to the development of the eXtensible Business Reporting Language (XBRL), which is an XML-based technology for the creation, dissemination, and publication as well as for the evaluation and comparison of financial information. By means of XBRL, information recipients focus on a single data format and can load company-specific financial information directly into information systems and/or decision support systems using the Internet. Furthermore, the economic justification of XBRL can be seen in the simplification of qualitative production and use of extensive company information. This means that you can readily use financial data for analysis in databases and reporting systems without complex and error-prone manual processing. In this context, XBRL is seen as the key element, both to increase the

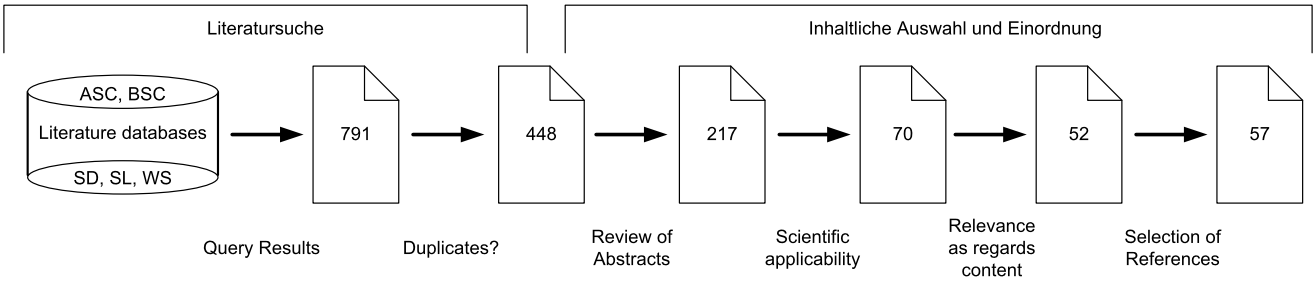

Fig. 1 Detailed approach for the literature review

transparency of financial reporting from and within companies and to increase market efficiency (Wagenhofer 2003).

After ten years of development, the Security Exchange Commission (SEC) defined XBRL as a mandatory format for financial reporting in the U.S. within the Interactive Data Program (SEC 2009). Thus, national and international companies listed in the U.S. are required to prepare and publish their financial reports using XBRL. This is done with the claim to use XBRL as a binding and exclusive format in the U.S. in future. However, recent financial reports show a very high potential for error when filing in XBRL format. The financial reports of 500 listed companies studied in this context show more than 18,000 faults of different kinds (McCann 2010). Moreover, particularly medium-sized companies do not know enough about the XBRL technology and can only react poorly (Johnson 2008), which is to be expected from German large and medium-sized enterprises as well.

In Germany, there has been a growing interest from the *Bundesanzeiger* to use XBRL in financial reporting since 2007. Although XBRL is not exclusively compulsory in this country to date, DATEV for instance collected more than 450,000 financial reports in XBRL and submitted them to the Bundesanzeiger or made them available to banks for credit analyses (Kesselmeier and Frank 2009, p. 73). In addition, the German tax authorities chose XBRL as the standard for data transmission within the federal-state project KONSENS (*Koordinierte neue Software-Entwicklung für die Steuerverwaltung*; engl. coordinated new software development for the tax administration) (XBRL 2008). Accordingly, the electronic reporting of tax accounts has been accomplished with XBRL since 2011. This decision will affect approximately two million companies which have to extend their IT in general and their financial and accounting systems in particular for using XBRL. A standard solution, such as those in electronic tax return (*elster*), is not expected. This results in consequences for companies in terms of their IT strategy, which also includes economic aspects.

From the perspective of a design-oriented business and information systems engineering (BISE) discipline, XBRL itself as well as its possible applications have to be investigated and developed in to the extent in which it is used as an integrated format in IT systems. Concepts of data description and data management are necessary to enable companies to adopt XBRL within their systems in order to take advantage of the associated potential. In this context, this study aims to identify the status quo of XBRL research in a first step. In particular, the facts resulting from a systematic literature review will show what is achieved by XBRL research and whether the above-mentioned demands are part of the research. Here, the used research methods, addressed contents, and the research design of previous contributions provide further information on future research topics.

As a demarcating fact it should be mentioned that the contribution exclusively addresses XBRL research. For a presentation of the standard itself, e.g. from a technical point of view, we refer to Debreceny et al. (2009) or Hoffman (2006).

Subsequent to this introduction, Sect. 2 explains the methodical approach of the systematic literature review. Then, Sect. 3 focuses on the discussion of recent research, before future research topics are discussed in Sect. 4. Section 5 summarizes the paper.

2 Methodology

The methodology is based on the systematic literature review approach recommended by Webster and Watson (2002) and Fettke (2006) which provides a thematic and structured overview. Consequently, the paper focuses on research topics in the context of XBRL (concept-centric).

As a starting point of the study, literature databases are used. These were searched through using specific keywords in the abstracts, titles, and full texts of stored contributions. At this point, the authors are aware of the fact that other articles may exist. However, we assume that the paper provides an almost complete overview due to the chosen form of literature review, the selected databases and the mechanisms mentioned below.

For the search we used the databases:

- EBSCOhost – Academic Source Complete (ASC),
- EBSCOhost – Business Source Complete (BSC),
- Springer Link (SL),
- ScienceDirect (SD), and
- the WISO (WAS) Database.

In addition, the references from the relevant contributions were integrated into the search process. The detailed approach is shown in **Fig. 1**.

First, the databases were queried based on the search terms *XBRL* and *eXtensible Business Reporting Language*. This resulted in 791 articles. Subsequently, one of the authors checked the results for duplicates. Using the bibliographic software RefWorks® and manual testing, 448 articles remained. These articles were reviewed manually by two authors as to their suitability. Books, articles from newspapers, book reviews, and short reports with only a few lines as well as other documents erroneously deemed relevant in terms of content during the database search, were excluded. This step resulted in a reduction to 217 articles.

For further consideration, the remaining articles were subjected to a clear scientific review process. This limitation was set in order to both reflect the actual state of research and also guarantee a high scientific quality of the articles

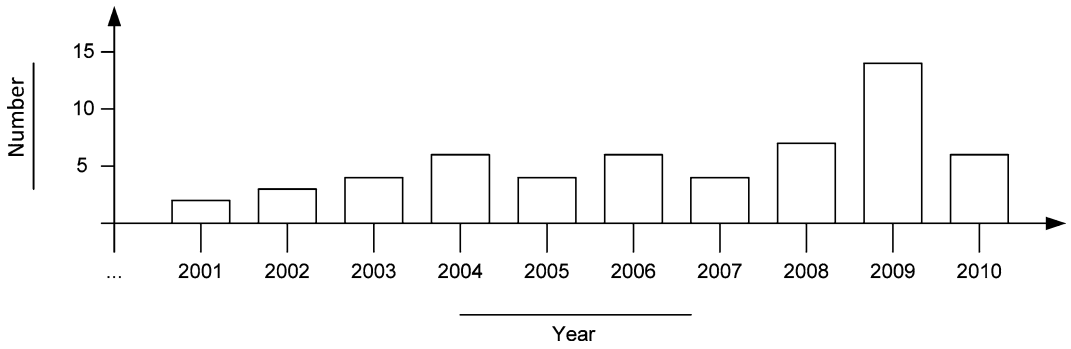

Fig. 2 Frequency of scientific articles dealing with XBRL over time

used for further investigation. Possible book chapters and contributions from non-scientific journals or online magazines (e.g., CFO.com) were not considered in this context. This led to a reduction to 70 articles.

In a next step two authors manually and independently analyzed the particular articles completely. In case of a dispute regarding the suitability and relevance of an article, the third author was involved in the decision. In doing so, only those publications were considered that scientifically dealt with XBRL. Articles just mentioning XBRL, for instance, without dealing with the issue in a scientific way, were excluded. This resulted in 52 articles to be considered as relevant. Another five followed after studying the references of the 51 contributions, so that the literature analysis is based on 57 articles from 37 journals.[1]

The classification of the identified publications was based on Palvia et al. (2004, pp. 529–530) considering the dimensions of research design, research methodology, and research content.

The dimension *research design* provides an overview of the underlying approach of the work under consideration. A categorization is made according to empirical-quantitative, empirical-qualitative, and non-empirical research. Non-empirical work is divided into design-oriented papers and conceptual work.

The dimension *research methodology* describes the methods used in the investigation. A differentiation is made between conventional methods of data collection and data analysis in empirical work (e.g., survey, interview, descriptive statistics, test statistics, content analysis, case study) and *other* methodological approaches (e.g., prototyping, simulation, modeling, literature review) in non-empirical research (Palvia et al. 2004, p. 529; Vessey et al. 2002, pp. 142–145).

The dimension *research content* is derived from a content classification of the contributions.

3 Evaluation of Publications

All analyzed articles relate to a period between 2001 and 2010. **Figure 2** visualizes the frequencies over time.[2]

The figure shows a significant increase in publications in 2009. This peak can be attributed to a special focus issue of the *International Journal of Disclosure & Governance* as well as to the availability of the first empirical data from real XBRL based financial reports from 2008.

In the course of the investigation it turned out that the majority of all examined publications follow an empirical research design (25). Here, 18 publications are based on a quantitative and 7 on a qualitative research design. In addition, 21 articles show a non-empirical research design and can be categorized as either design-oriented research (9) or conceptual research (12). Contributions that do not explicitly explain their research design and could not be assigned even after a detailed examination were classified as *Other* (11).

The used research methods are descriptive methods (16), surveys (3), experiments (2), case study research (4), or interview research (3). Also methodological approaches, such as prototyping (7), simulation (1), and literature analysis & theory-based research (8), are taken into account. Contributions without an explicitly identifiable research methodology were classified as other (15).[3]

With regard to research topics, we observed a substantive differentiation in contributions on the research with XBRL as well as contributions on research on XBRL. The articles on research on XBRL can be further divided into research on standards, reporting, and others. **Table 1** provides a summarizing overview of all identified articles classified according to their research content.

Publications on research with XBRL aim to adapt the characteristics of XBRL and transfer these to other fields. This is either done through the development of new, domain-specific languages or by deriving methods which functionally include XBRL.

Authors conducting research on XBRL consider XBRL as the standard and investigate its *adoption and diffusion*. Furthermore, they address specific issues that concern the reporting process. To this end they examine technical aspects, evaluate quality issues, or discuss changes by XBRL for instance. *Other* publications deal with issues concerning *research*, *teaching*, and *what is XBRL*.

3.1 Research with XBRL

In the context of domain-specific languages, Gräning and Kienegger (2007) describe the suitability of XBRL for energy reporting in the European Union (EU). In this article, XBRL is applied to make use of structures from the Datamine project on the basis of XBRL taxonomies for the reporting of the energy performance of buildings (Gräning and Kienegger 2007, pp. 374 f).

Boritz and No (2004) develop the eXtensible Assurance Reporting Language

[1] A complete list of journals can be found in **Table A-3**.
[2] However, it has to be mentioned that the temporal restriction is not intended, but naturally results from the history of XBRL.
[3] A complete overview of research methods and research design can be found in **Tables A-1** and **A-2**.

Table 1 Classification according to research content

Types	Topics	#	References
With XBRL	Domain specific languages	6	Bonsón et al. (2008); Boritz and No (2004); Branson (2002); Cho and Roberts (2010); Gräning and Kienegger (2007); Mena et al. (2010)
	Method development	1	Spies (2010)
On XBRL	Research on standards		
	Adoption & diffusion	13	Apostolou and Nanopoulos (2009); Bonsón et al. (2009a, 2009b); Bonsón et al. (2010); Cohen (2004); Gray and Miller (2009); Lester (2007); Piechocki et al. (2009); Pinsker and Li (2008); Troshani and Doolin (2007); Troshani and Lymer (2010); Vasile et al. (2009); Yoon et al. (2011)
	Reporting		
	Quality assurance	7	Boritz and No (2008); Boritz and No (2009); Bovee et al. (2002); Debreceny et al. (2010); Fengyi et al. (2005); Plumlee and Plumlee (2008); Watson (2009)
	Changes through XBRL	7	Hodge et al. (2004); Mejzlik and Istvanfyova (2008); Pinsker and Wheeler (2009); Premuroso and Bhattacharya (2008); Ray and Das (2009); Schuster and O'Connell (2006); Wagenhofer (2003)
	XBRL as technology	6	Berkeley et al. (2009); Boritz and No (2005); Bovee et al. (2005); Cohen (2009); Piechocki et al. (2009); Woodroof and Searcy (2001)
	Other		
	"What is XBRL"	6	Deshmukh (2004); Farewell (2006); Kranich and Schmitz (2003); Nutz and Strauß (2002); Pinsker (2003); Ramin and Kesselmeyer (2007)
	Research	6	Alles et al. (2008); Baldwin et al. (2006); Debreceny et al. (2005); Debreceny and Gray (2001); Doolin and Troshani (2004); Williams et al. (2006)
	Teaching	2	Pinsker (2004); Taylor and Dzuranin (2010);
	Other	3	Burnett et al. (2006); Fahy et al. (2009); Locke and Lowe (2007)

(XARL) as an extended reporting language with concepts enhancing the integrity of XBRL documents by additional descriptions (Boritz and No 2004, p. 209).

Mena et al. (2010) describe the use of XBRL to improve the quality of project documentation in Spain. In this context, the requirements of the national standard *UNE 157001:2002 General criteria to develop projects* (Mena et al. 2010, p. 277) are transferred to the XBRL as XPDRL for the documentation of projects and the transfer of project-related data.

As part of method development Spies (2010) reverts to the description of reporting concepts of XBRL taxonomies and develops an ontology-based reporting approach that is able to transfer both structured and unstructured data based on XBRL technology.

3.2 Research on XBRL

3.2.1 Research on Standards

The *adoption and diffusion* of XBRL is considered in 13 contributions. Apostolou and Nanopoulos (2009) deal with the distribution of XBRL in terms of the International Financial Reporting Standards (IFRS) and identify advantages for companies in Europe. The study shows the benefits of XBRL for transparent financial reporting. At the same time, the authors consider the potential of XBRL adoption as being restricted and therefore do not see XBRL as a trigger for changing from many to just one global reporting standard.

Piechocki and Gräning (2008) discuss the problem of critical mass which is necessary for an enforcement of XBRL as a standard. On the basis of descriptive data, the authors examine the *penguin and bandwagon effect*.[4] Considering geographical distribution, in their view the critical mass is reached. However, there is a lack of diffusion among users of financial information. Reasons for these phenomena are not mentioned.

Gray and Miller (2009) conduct expert interviews in companies in order to gain insights regarding the degree of adoption of XBRL. The results support a low adoption by companies and point out an insufficient information supply of the addressed users as a major cause.

Troshani and Doolin (2007) as well as Troshani and Lymer (2010) analyze the diffusion of XBRL in Australia. Troshani and Doolin (2007) compare the results with theories of innovation research. They point to a strong influence of government agencies in the dissemination of XBRL in Australia. Troshani and Lymer (2010) observe the impact of *adoption and diffusion* on social networks and discuss the implications for the standardization process (Troshani and Lymer 2010, pp. 154 ff).

Pinsker and Li (2008) deal with the cost-effectiveness of using XBRL. They examine the positive and negative effects for companies and support their research with expert interviews. Respondents estimate the benefits associated with XBRL to be larger than the expected implementation costs and consider XBRL to be a key technology (Pinsker and Li 2008, p. 49).

Bonsón et al. (2010) discuss the use of XBRL in the context of the Common Reporting (COREP)[5] and Basel II, focusing on the advantages regarding the use of XBRL as the standard format for reporting to and from the European bank-

[4] In networking theory the penguin effect describes a waiting attitude concerning the adoption of a standard (Choi 1997, pp. 407 ff). The bandwagon effect refers to reaching a critical mass regarding the diffusion of a standard (Granovetter 1978, pp. 1420 ff).

[5] Common Reporting contains a taxonomy based on XBRL with the rules of Basel II for reporting between financial institutes and the particular supervisory authorities and was commissioned by the Committee of European Banking Supervisors (CEBS).

ing supervisory authorities. In this context, Bonsón et al. (2009b) examine models for the adoption of XBRL from the perspective of regulators. They describe a voluntary model and a compulsory model, with the voluntary model inviting to report with XBRL and the compulsory model requiring reporting with XBRL (Bonsón et al. 2009b, p. 39). Both models are compared on the basis of relevant criteria and discussed with regard to adoption. According to the results, a uniform approach for all countries is not desirable as the political, economic, and social conditions are different. The decision for one of the two models, however, is the regulators' and supervisors' choice (Bonsón et al. 2009b, p. 40).

Yoon et al. (2011) deal with the question of whether the use of XBRL may reduce the information asymmetry prevailing in the Korean stock market. They use financial reports submitted in XBRL by Korean companies and test previously derived hypotheses using statistical methods. Their results show that, in particular for large enterprises, the effect of reducing information asymmetries is observable, whereas the significance decreases in the case of small and medium-sized enterprises.

3.2.2 Reporting

The category *quality assurance* in **Table 1** includes the contributions that mainly deal with data and reporting quality of XBRL-based financial reports. In the context of this study, Bovee et al. (2002) investigate how the XBRL-C&I taxonomy is likely to reflect the requirements of existing accounting standards. Here a comparison between 67 paper-based financial reports and the XBRL-C&I taxonomy in 2001 is carried out. The results show a poor compatibility between the two media.

Watson (2009) analyzes individual subreports (balance sheet, profit and loss statement, etc.) of 209 publicly traded Indian firms. The results show significant errors in XBRL-based financial reports. In the same manner, however, in the context of the Voluntary Filing Program of the SEC in 2008, Boritz and No (2008) investigate the quality of XBRL-based financial reports. The article examines the validity with respect to the Financial Reporting Taxonomy Architecture (FRTA) and the validity of company-specific XBRL taxonomies. The results show differences between the tested taxonomies and the FRTA. Reasons for this can be primarily seen in the unnecessary use of company-specific taxonomy extensions (Boritz and No 2008, p. 48). In relation to data quality, Debreceny et al. (2010) aim to provide starting points for improving data quality. The study is based on financial reports of firms from different industry sectors and identifies different types of errors. In their results, the authors point to the preventability of many errors and weaknesses in the underlying taxonomy.

Fengyi et al. (2005) focus on the use of XBRL to improve the quality of the submitted financial information. This aim is achieved within their *eChain bank accounting systems framework* through the integration of XBRL in conjunction with web services and web intelligence (Fengyi et al. 2005, pp. 295 ff).

The category *changes through XBRL* includes publications where the authors discuss the possible impacts and associated changes of an Internet-based financial reporting using XBRL. Here, Wagenhofer (2003) argues transaction costs decrease through a web-based and semantic financial reporting. In a second step, he discusses the issue of standardization of financial reporting with respect to content and questions the necessity of the existence of a variety of accounting regulations. In his view, a uniform accounting standard may support the use of XBRL.

Another sub-field deals with corporate governance and corporate reporting and the changes in these fields. Ray and Das (2009) discuss the use of XBRL as part of their Corporate Reporting Framework and observe changes in terms of transparency, integrity, and the ability to report financial data through the use of XBRL (Ray and Das 2009, p. 109).

The studies by Hodge et al. (2004) provide starting points for achieving a higher transparency in the use of XBRL. Pinsker and Wheeler (2009) also test the effect of using XBRL and show that the group using XBRL is more efficient and more effective than a comparison group working in a paper-based way (Pinsker and Wheeler 2009, pp. 253 ff). The study confirms the findings of Hodge et al. (2004).

The category of *XBRL as technology* includes articles that deal with technical issues such as taxonomy extensions, taxonomy design, and the integration of XBRL in IT systems. In this context, Bovee et al. (2005) develop the *Financial Reporting and Auditing Agent with Net Knowledge* (FRAANK). This prototype scans the Internet for XBRL instances through an agent in order to make these available in bundles for financial analysis. Cohen (2009) deals with the lack of integration of the XBRL General Ledger (XBRL GL) in ERP systems and points to further potential of XBRL since – despite the use of XBRL – the consolidation of financial reports requires manual intervention, and thus comparability and transparency are missing. Piechocki et al. (2009) discuss the technical possibilities for the design of taxonomies by means of investigating existing taxonomies with the help of four case studies. Their results show that the expansion of core taxonomies provides a greater flexibility but raises costs of analysis and the authors point to the problem of extending XBRL taxonomies.

Boritz and No (2005) develop a *Web Services Security Architecture* as an approach to a secure, Internet-based financial reporting. In a framework the authors show how XBRL, or XARL respectively, should be integrated using specific protocols (e.g., WSDL, SOAP) and how this is supposed to work.

3.2.3 Others

The publications that explain XBRL (6), that is those presenting and discussing the functionality, the environment, and the advantages and disadvantages of XBRL in the form of scientific papers based on the reproduction of literature, are, e.g., Nutz and Strauß (2002) and Kranich and Schmitz (2003).

Publications from the categories *research* (6) and *teaching* (2) deal with overviews of relevant research topics and approaches on how XBRL should be integrated into *Accounting Education*. Alles et al. (2008) identify various scientific disciplines, indicate synergies that exist between the various disciplines, and show how these should be deepened. Furthermore, Baldwin et al. (2006), Debreceny and Gray (2001), and Debreceny et al. (2005) identify future research topics as regards XBRL. Baldwin et al. (2006) present a list including topics such as data quality, use and dissemination as well as the *Reporting Industry Supply Chain* (Baldwin et al. 2006, p. 108). Debreceny et al. (2005) refer to issues that deal with the taxonomy itself, the extensions, and the storage of the instances. These and other issues can also be found in Doolin and Troshani (2004) who distinguish research with XBRL according to the categories "as a technology, as

a standard, as a business tool [and] in education" (Doolin and Troshani 2004, p. 100). Williams et al. (2006) consider XBRL from the perspective of information management and conclude implications for research from the analysis of projects with XBRL.

As part of the category *teaching*, Pinsker (2004) provides an approach about how XBRL may be involved in teaching. Moreover, Taylor and Dzuranin (2010) show how the necessary knowledge may be conveyed in a better way within the subject of Accounting Information Systems by using XBRL since both technical (taxonomies, data exchange, data storage) and content concepts (legislation, etc.) must be included.

Doolin and Troshani (2004), Debreceny and Gray (2001), Debreceny et al. (2005), and Baldwin et al. (2006) already describe what XBRL research is meant to achieve. Compared to the identified categories, however, a sufficient difference exists regarding the topics proposed by these papers. In the following, this difference gives cause for the discussion of future research topics.

4 Future Research Topics

4.1 Future Research on Adoption and Diffusion

4.1.1 Factors Influencing the Diffusion of XBRL

The analysis illustrates the influence of regulatory and supervisory authorities (SEC, Australian Prudential Regulation Authority, CEBS) as key drivers for the implementation of XBRL as a standard. Bonsón et al. (2009a, 2009b) discuss this aspect in the context of the compulsory and voluntary models presented in their contribution. There is a lack of comparative studies that indicate the process of standardization of XBRL with similar standards. Hence, the question arises of whether it is in the nature of XBRL or whether it may be regarded as a causal weakness of XBRL that regulators are necessary for enforcement. Accordingly, and also with regard to the obligation of XBRL reporting in Germany, investigations are indispensable which differentiate the adoption and diffusion of XBRL by country and identify other factors accelerating or decelerating the diffusion of XBRL. In addition to supervisory authorities, regulators, or standardization organizations, it is essential that these studies involve companies in order to use the latter's experience in the course of an obviously non-voluntary adoption of XBRL. Associated with this, the existing approaches by Pinsker and Li (2008) are not significant as regards the expected implementation costs since the results allow no conclusions as to actual costs incurred in the adoption. Accordingly, research potential exists regarding the investigation of actually emerging economic advantages and disadvantages over the entire reporting chain.

4.2 Future Research on Reporting

4.2.1 Quality Assurance of Future Reporting with XBRL

Many papers address the quality of reporting with XBRL. Publications from 2008 to 2010 address quality problems relating to the reported data. However, only Debreceny et al. (2010) identify the sources of the errors. Others only point to the fact that there are significant sources of error. However, there has been no research that deals with the development of concepts and methods for preventing errors. In addition, no existing publication provides a critical reflection of XBRL in terms of data quality in conjunction with taxonomy development and taxonomy design. This issue was already identified by Debreceny et al. (2005) as an essential research topic. Nevertheless, there is a lack of investigations comparing reports of various taxonomies in terms of data quality and thus providing starting points, such as whether a particular taxonomy design or a particular group of users causes significantly less or more errors.

4.2.2 Comparability of XBRL-Based Financial Reports

As regards the comparability, algorithms are necessary to approach the financial analysis. Here, the problems caused by company specific taxonomy extensions must be considered as well as the possibility of different assessment approaches by accounting standards. For example, techniques of "structural alignment" or semantic concepts may provide approaches to XBRL-based financial analysis.

Based on the issue of transparency, it should be mentioned that despite the large number of publications there are hardly any qualitative or quantitative studies which focus on the real potential of transparency of XBRL and compare it to existing mechanisms in reporting.

4.2.3 Approaches to the Integration of XBRL in Financial and Accounting Systems

The examined articles describe the challenges and exclusively point to problems. However, only Bovee et al. (2005) provide a prototypical approach for data analysis. Predominantly, though, concepts are missing for the integration and extraction of XBRL data to and from existing information systems. This is because XBRL can only realize its full potential when it is used as an integrated standard in information systems and when even the processing of the data in the systems is done by use of XBRL. Only in this way may consolidated company reports become dispensable and can financial reporting be performed directly out of the systems. Thus, additional research is needed in terms of technical approaches that take into account these aspects.

4.2.4 XBRL Assurance

In addition, the principles of digital documents (*Grundsätze der Prüfung digitaler Unterlagen*, GdPdU) and thus the field of XBRL assurance represent a relevant issue. Currently, the accuracy of XBRL reports (and thus, for example, the choice of individual reporting concepts/tags) is verified using the classical submission (HTML or paper-based). Here a need can be identified to further develop XBRL in a way to support the verification of digital documents in a simplified manner and also to enable automated testing procedures of the relevant report, for instance. In the discussion, the principles of proper accounting systems (*Grundsätze ordnungsgemäßer Buchführungssysteme*, GoBS) are often associated with this issue. Moreover, the extent has to be examined to which XBRL also contributes to the provision of long-term revision-proof and legally-relevant information with the meaning of *pervasive information*.

4.2.5 Taxonomy Development and Taxonomy Design

Furthermore, the progressive development in taxonomy modeling leads to a change in reporting. The reported data

of taxonomy models are no longer considered document-oriented, but are divided into multi-dimensional perspectives. Experiences from logical modeling, especially multi-dimensional modeling from online analytical processing (OLAP), can then be transferred to taxonomy design. This leads to business-intelligence-oriented research.

4.3 Future Research in Other Fields

In essence, it seems advisable to discuss the concepts of *information value chain*, *information chain*, *information supply chain*, and *financial reporting supply chain*. The terms are often used within the papers. However, they are not considered in a differentiated way. For example, there is a contradictory use of terms, such as that the *supply chain* has the characteristic of a *bullwhip effect* (The bullwhip effect refers to the fact that information asymmetries in an information chain increase from source to destination. The term takes a central role in supply chain management since it indicates the necessity of integration and coordination along the supply chain; Lee et al. 1997, pp. 93 ff.) which, however, does not exist in the context of XBRL. Furthermore, the concept of a *value chain* is to be questioned, since so far only the author of a report provides data without being interconnected with the receiver of the report through the processes described. Here, it is up to discussion what can be considered the subject of value creation that is meant to result from such a value chain. In addition, this discussion supports a value-creation-oriented control of information logistics.

5 Summary

The importance of XBRL as financial reporting standard is increasing, and thus also the relevance of the discussion of this standard. Therefore, this paper aims to present the state of research on XBRL in terms of research design, research methods, and research content. To this end, literature databases were searched and we identified 57 articles from 37 journals.

The research gaps identified through the systematic literature review highlight the need for discussion of future research topics. Especially in view of the large number of empirical contributions there is a strong demand for design-oriented concepts. It has to be clearly stated that the approaches to an integrative use of XBRL and the associated integration, extraction, and analysis of data appear especially urgent. Only in this way the full potential of XBRL becomes available. In this context, also economic issues are important, which, in addition to the existing technical advantages, also consider the economic viewpoint. Other future research topics support the use of XBRL and require further empirical studies that help practitioners and researchers to better understand the use of XBRL.

In particular, the discipline of BISE can take a central role in future and may prominently position itself on the European side in XBRL research next to the U.S. subject of Accounting Information Systems. Its focus on the design and use of computer-based information and communication systems in companies and public administration is in accordance with what is currently required in XBRL research.

References

Alles MG, Kogan A, Vasarhelyi MA (2008) Exploiting comparative advantage: a paradigm for value added research in accounting information systems. International Journal of Accounting Information Systems 9(4):202–215

Apostolou AK, Nanopoulos KA (2009) Interactive financial reporting using XBRL: an overview of the global markets and Europe. International Journal of Disclosure & Governance 6(3):262–272

Baldwin AA, Brown CE, Trinkle BS (2006) XBRL: an impacts framework and research challenge. Journal of Emerging Technologies in Accounting 3:97–116

Berkeley A, Donahue DF, Moyer PD, Bolgiano MC (2009) XBRL reaches tipping point. Journal of Securities Operations & Custody 2(2):128–133

Bonsón E, Cortijo V, Escobar T (2008) The role of XBRL in enhanced business reporting (EBR). Journal of Emerging Technologies in Accounting 5:161–173

Bonsón E, Cortijo V, Escobar T (2009a) Towards the global adoption of XBRL using international financial reporting standards (IFRS). International Journal of Accounting Information Systems 10(1):46–60

Bonsón E, Cortijo V, Escobar T, Flores F (2009b) Implementing XBRL successfully by mandate and voluntarily. Online 33(1):37–40

Bonsón E, Cortijo V, Escobar T, Flores F, Monreal S (2010) Solvency II and XBRL: new rules and technologies in insurance supervision. Journal of Financial Regulation and Compliance 18(2):144–157

Boritz JE, No WG (2004) Assurance on XML based information services: XARL. Canadian Accounting Perspective 3(2):207–233

Boritz JE, No WG (2005) Security in XML-based financial reporting services on the Internet. Journal of Accounting & Public Policy 24(1):11–35

Boritz JE, No WG (2008) The SEC's XBRL voluntary filing program on EDGAR: a case for

Abstract

André Gräning, Carsten Felden, Maciej Piechocki

Status Quo and Potential of XBRL for Business and Information Systems Engineering

The paper examines the current state of research as regards the eXtensible Business Reporting Language (XBRL) by using the literature review methodology. The results show that an empirical-quantitative research design is used most of the time. The contributions vary in substance in terms of research on XBRL and research with XBRL. Research with XBRL focuses on the development of conceptual XBRL extensions. Work on XBRL considers, for example, the changes in reporting as a result of XBRL as well as the acceptance and enforcement of financial reporting standards. The results point to open issues and are relevant for research and practice.

Keywords: XBRL, eBusiness standard, Financial reporting, Literature review

quality assurance. Current Issues in Auditing 2(2):36–50
Boritz JE, No WG (2009) Assurance on XBRL-related documents: the case of united technologies corporation. J Inf Syst 23(2):49–78
Bovee M, Ettredge ML, Srivastava RP, Vasarhelyi MA (2002) Does the year 2000 XBRL taxonomy accommodate current business financial-reporting practice? J Inf Syst 16(2):165–182
Bovee M, Kogan A, Nelson K, Srivastava RP, Vasarhelyi MA (2005) Financial reporting and auditing agent with net knowledge (FRAANK) and extensible business reporting language (XBRL). J Inf Syst 19(1):19–41
Branson M (2002) Using XBRL for data reporting. Statistical Journal of the UN Economic Commission for Europe 19(3):201
Burnett RD, Friedman M, Murthy U (2006) Financial reports: why you need XBRL. Journal of Corporate Accounting & Finance (Wiley) 17(5):33–40
Cho CH, Roberts RW (2010) Environmental reporting on the Internet by America's Toxic 100: legitimacy and self-presentation. International Journal of Accounting Information Systems 11(1):1–16
Choi JP (1997) Herd behavior, the "penguin effect" and the suppression of informational diffusion: an analysis of informational externalities and payoff interdependency. RAND Journal of Economics 28(3):407–425
Cohen E (2004) Compromise or customize: XBRL's paradoxical power. CAP Forum on E-Business 3(2):187–206
Cohen E (2009) XBRL's Global ledger framework: exploring the standardized missing link to ERP integration. International Journal of Disclosure & Governance 6(3):188–206
Debreceny R, Gray GL (2001) The production and use of semantically rich accounting reports on the Internet: XML and XBRL. International Journal of Accounting Information Systems 2(1):47–74
Debreceny R, Chandra A, Cheh JJ, Guithues-Amrhein D, Hannon NJ, Hutchison PD, Janvrin D, Jones RA, Lamberton B, Lymer A, Mascha M, Nehmer R, Roohani S, Srivastava RP, Trabelsi S, Tribunella T, Trites G, Vasarhelyi MA (2005) Financial reporting in XBRL on the SEC's EDGAR system: a critique and evaluation. J Inf Syst 19(2):191–210
Debreceny R, Felden C, Ochocki B, Piechocki M, Piechocki M (2009) XBRL for interactive data: engineering the information value chain. Springer, Berlin
Debreceny R, Farewell S, Piechocki M, Felden C, Gräning A (2010) Does it add up? Early evidence on the data quality of XBRL filings to the SEC. J Account Public Policy 29(3):296–306
Deshmukh A (2004) Xbrl. Communications of AIS 2004(13):196–219
Doolin B, Troshani I (2004) XBRL. a research note. Qualitative Research in Accounting & Management 1(2):93–104
Fahy M, Feller J, Finnegan P, Murphy C (2009) Co-operatively re-engineering a financial services information supply chain: a case study. Canadian Journal of Administrative Sciences (Canadian Journal of Administrative Sciences) 26(2):125–135
Farewell SM (2006) An Introduction to XBRL through the use of research and technical assignments. J Inf Syst 20(1):161–185
Fengyi L, Sheng ORL, Wu S (2005) An integrated framework for eChain bank accounting systems. Industrial Management & Data Systems 105(3):291–306
Fettke P (2006) State-of-the-Art des State-of-the-Art: Eine Untersuchung der Forschungsmethode "Review" innerhalb der Wirtschaftsinformatik. Wirtschaftsinformatik 48(4):257–266
Gräning A, Kienegger H (2007) Standardisierung der europaweiten Berichterstattung im Rahmen der Messung der Gesamtenergieeffizienz von Gebäuden. WIRTSCHAFTSINFORMATIK 49(5):370–379
Granovetter M (1978) Threshold models of collective behavior. American Journal of Sociology 83:1420–1443
Gray GL, Miller DW (2009) XBRL: solving real-world problems. International Journal of Disclosure & Governance 6(3):207–223
Hodge FD, Kennedy JJ, Maines LA (2004) Does search-facilitating technology improve the transparency of financial reporting? Accounting Review 79(3):687–703
Hoffman C (2006) Financial reporting using XBRL, IFRS and US GAAP Edition. Lulu.com
Johnson S (2008) CFOs anticipate a filing crunch. http://www.cfo.com/article.cfm/11877821?f=related. Accessed: 2009-01-10
Kernan K (2009) The story of our new language: personalities, cultures, and politics combine to create a common, global language for business. American Institute of Certified Public Accountants: pp 1–30
Kesselmeier B, Frank R (2009) Kapitalmarktkommunikation. Schlüsseltechnologie XBRL IT & Kommunikation 2:72
Kranich P Schmitz H (2003) Die extensible business reporting language. Wirtschaftsinformatik 1:77–80
Lee HL, Padmanabhan V, Whang S (1997) The bullwhip effect in supply chains. Sloan Management Review 38(3):93–102
Lester WF (2007) Xbrl: the new language of corporate financial reporting. Business Communication Quarterly 70(2):226–231
Locke J, Lowe A (2007) XBRL: an (open) source of enlightenment or disillusion? European Accounting Review 16(3):585–623
McCann D (2010) 18,000 Tagging errors in XBRL filings so far. http://www.cfo.com/article.cfm/14529555?f=most_read
Mejzlik L, Istvanfyova J (2008) XBRL – the tool for automated semantic readability of electronic financial statements. International Journal of Technology Transfer & Commercialisation 7(1):7–7
Mena Á, López F, Framiñan JM, Flores F, Gallego JM (2010) XPDRL project: improving the project documentation quality in the Spanish architectural engineering and construction sector. Autom Constr 19(2):270–282
Nutz A, Strauß M (2002) eXtensible business reporting language (XBRL) Konzept und praktischer Einsatz. WIRTSCHAFTSINFORMATIK 44(5):447–457
Palvia P, Leary D, Mao E, Midha V, Pinjani P, Salam AF (2004) Research methodologies in MIS: an update. Communications of the Association for Information Systems 14:526–542
Piechocki M, Gräning A (2008) Standardisation level of the eXtensible business reporting language. Business Information Technology 9(1):5–16
Piechocki M, Felden C, Gräning A, Debreceny R (2009) Design and standardisation of XBRL solutions for governance and transparency. International Journal of Disclosure & Governance 6(3):224–240
Pinsker R (2003) XBRL awareness in auditing: a sleeping giant? Managerial Auditing Journal 18(9):732–736
Pinsker R (2004) Teaching XBRL to graduate business students: a hands-on approach. Journal of STEM Education: Innovations & Research 5(1):5–17
Pinsker R, Li S (2008) Costs and benefits of Xbrl adoption: early evidence. Commun ACM 51(3):47–50
Pinsker R, Wheeler P (2009) Nonprofessional investors' perceptions of the efficiency and effectiveness of XBRL-enabled financial statement analysis and of firms providing XBRL-formatted information. International Journal of Disclosure & Governance 6(3):241–261
Plumlee RD, Plumlee MA (2008) Assurance on XBRL for financial reporting. Accounting Horizons 22(3):353–368
Premuroso RF, Bhattacharya S (2008) Do early and voluntary filers of financial information in XBRL format signal superior corporate governance and operating performance?. International Journal of Accounting Information Systems 9(1):1–20
Ramin KP, Kesselmeyer B (2007) XBRL als internetbasierter Standard für die Finanzberichterstattung. KoR Zeitschrift für internationale und kapitalmarktorientierte Rechnungslegung 7(10):560–571
Ray S, Das S (2009) Corporate reporting framework (CRF): benchmarking tata motors against AB Volvo and exploring future challenges decision (0304-0941). Das Decision 36(1):101–129
Schuster P, O'Connell V (2006) The trend toward voluntary corporate disclosures. Management Accounting Quarterly 7(2):1–9
SEC (2009) Final rule: interactive data to improve financial reporting. http://www.sec.gov/rules/final/2009/33-9002.pdf. Accessed 2009-07-20
Spies M (2010) An ontology modelling perspective on business reporting. Inf Syst 35(4):404–416
Taylor EZ, Dzuranin AC (2010) Interactive financial reporting: an introduction to eXtensible business reporting language (XBRL). Issues in Accounting Education 25(1):71–83
Troshani I, Doolin B (2007) Innovation diffusion: a stakeholder and social network view. European Journal of Innovation Management 10(2):176–200
Troshani I, Lymer A (2010) Translation in XBRL standardization. Information Technology & People 23(2):136–164
Vasile F, Petronel AC, Georgel TC (2009) The normalization of financial data exchange over the Internet: adopting international standard Xbrl. Annals of the university of Oradea. Economic Science Series 18(4):935–939
Vessey I, Ramesh V, Glass RL (2002) Research in information systems: an empirical study of diversity in the discipline and its journals. Journal of Management Information Systems 19(2):129–174
Wagenhofer A (2003) Economic consequences of Internet financial reporting. Schmalenbach Business Review (SBR) 55(4):262–279
Watson LA (2009) Sorry wrong number – study finds financial results of 209 listed Indian companies don't add up. International Journal of Disclosure & Governance 6(3):185–187
Webster J, Watson RT (2002) Analyzing the past preparing the future: writing a literature review. MIS Quarterly 26(2):xiii–xxiii
Williams SP, Scifleet PA, Hardy CA (2006) Online business reporting: an information management perspective. Int J Inf Manage 26(2):91–101

Woodroof J, Searcy D (2001) Continuous audit: model development and implementation within a debt covenant compliance domain. International Journal of Accounting Information Systems 2(3):169–191

Yoon H, Zo H, Ciganek AP (2011) Does XBRL adoption reduce information asymmetry? Journal of Business Research 64(2):157–163

XBRL (2008) E-Bilanz nach SteuBAG mit XBRL. http://www.xbrl.de/index.php?option=com_content&task=view&id=84&Itemid=7. Accessed 2010-7-20

Table A-1 Classification according to research design

Research Design		*References*
empirical (25)	quantitative (18)	Apostolou u. Nanopoulos (2009); Baldwin et al. (2006); Bonsón et al. (2009b); Boritz u. No (2008); Bovee et al. (2002); Cho u. Roberts (2010); Debreceny et al. (2010); Debreceny et al. (2005); Debreceny u. Gray (2001); Deshmukh A (2004); Piechocki u. Gräning (2008); Piechocki et al. (2009); Pinsker (2003); Pinsker u. Li (2008); Premuroso u. Bhattacharya (2008); Wagenhofer (2003); Watson (2009); Yoon et al. (2011)
	qualitative (7)	Boritz u. No (2009); Fahy et al. (2009); Gray u. Miller (2009); Hodge et al. (2004); Pinsker u. Wheeler (2009); Troshani u. Doolin (2007); Troshani u. Lymer (2010)
non-empirical(21)	Design-orientied (9)	Bonsón et al. (2008); Boritz u. No (2004); Bovee et al. (2005); Fengyi et al. (2005); Gräning u. Kienegger (2007); Mena et al (2010); Ray u. Das (2009); Spies (2010); Woodroof u. Searcy (2001),
	conceptual (12)	Alles et al. (2008); Bonsón et al. (2009a); Boritz u. No (2005); Cohen (2009); Doolin u. Troshani (2004); Farewell (2006); Locke u. Lowe (2007); Nutz u. Strauß (2002); Pinsker (2004); Plumlee u. Plumlee (2008); Vasile et al. (2009); Williams et al. (2006)
others (11)		Berkeley et al. (2009); Bonsón et al. (2010); Branson (2002); Burnett et al. (2006); Cohen (2004); Kranich u. Schmitz (2003); Lester (2007); Mejzlik u. Istvanfyova (2008); Ramin u. Kesselmeyer (2007); Schuster u. O'Connell (2006); Taylor u. Dzuranin (2010)

Table A-2 Classification according to research methods

Research methods	*References (multiple entires possible)*
Survey (3)	Pinsker (2003); Pinsker u. Li (2008); Watson (2009)
Interview	Debreceny et al. (2005); Gray u. Miller (2009); Troshani u. Doolin (2007); Troshani u. Lymer (2010); Williams et al. (2006)
descriptive Methodology (16)	Apostolou u. Nanopoulos (2009); Bonsón et al. (2009b); Boritz u. No (2009); Boritz u. No (2008); Bovee et al. (2002); Cho u. Roberts (2010); Debreceny et al. (2010); Debreceny et al. (2005); Debreceny u. Gray (2001); Locke u. Lowe (2007); Piechocki et al. (2009); Piechocki u. Gräning (2008); Plumlee u. Plumlee (2008); Premuroso u. Bhattacharya (2008); Watson (2009); Yoon et al. (2011)
Experiment (2)	Hodge et al. (2004); Pinsker u. Wheeler (2009)
Case Study (5)	Boritz u. No (2009); Branson (2002); Fahy et al. (2009); Piechocki et al. (2009); Williams et al. (2006)
Prototyping (7)	Boritz u. No (2004); Bovee et al. (2005); Fengyi et al. (2005); Gräning u. Kienegger (2007); Mena et al (2010); Spies (2009); Woodroof u. Searcy (2001)
Simulation (1)	Bovee et al. (2005)
Modells and Frameworks (7)	Alles et al. (2008); Bonsón et al. (2008); Bonsón et al. (2009a); Boritz u. No (2005); Ray u. Das (2009); Vasile et al. (2009); Woodroof u. Searcy (2001)
Literature Review or theory based research (9)	Baldwin et al. (2006); Debreceny et al. (2005); Farewell (2006); Gray u. Miller (2009); Locke u. Lowe (2007); Pinsker u. Wheeler (2009); Premuroso u. Bhattacharya (2008); Ray u. Das (2009); Wagenhofer (2003)
Others (15)	Berkeley et al. (2009); Bonsón et al. (2010); Burnett et al. (2006); Cohen (2004); Cohen (2009); Deshmukh (2004); Doolin u. Troshani (2004); Kranich u. Schmitz (2003); Lester (2007) Mejzlik u. Istvanfyova (2008); Nutz u. Strauß (2002); Pinsker (2004); Ramin u. Kesselmeyer (2007); Schuster u. O'Connell (2006); Taylor u. Dzuranin (2010)

Table A-3 Number of Paper sorted by Scientific Journal

#	*Zeitschrift*	*Anzahl*
1	Accounting Horizon	1
2	Accounting Review	1
3	Annals of the University of Oradea, Economic Science Series	1
4	Automation in Construction	1
5	BIT - Business Information Technology	1
6	Canadian Journal of Administrative Sciences	1
7	CAP Forum on E-Business	2
8	Communications of AIS	1
9	Communications of the ACM	1
10	Current Issues in Auditing	2
11	Decision (0304-0941)	1
12	European Accounting Review	1
13	European Journal of Innovation Management	1
14	Industrial Management & Data Systems	1
15	Information Systems	1
16	Information Technology & People	1
17	International Journal of Accounting Information Systems	6
18	International Journal of Disclosure & Governance	6
19	International Journal of Information Management	1
20	International Journal of Technology Transfer & Commercialisation	1
21	Issues in Accounting Education	1
22	Journal of Accounting & Public Policy	2
23	Journal of Business Research	1
24	Journal of Corporate Accounting & Finance (Wiley)	1
25	Journal of Emerging Technologies in Accounting	2
26	Journal of Financial Regulation and Compliance	1
27	Journal of Information Systems	5
28	Journal of Securities Operations & Custody	1
29	Journal of STEM Education: Innovations & Research	1
30	Management Accounting Quarterly	1

31	Managerial Auditing Journal	1
32	Online	1
33	Qualitative Research in Accounting & Management	1
34	Schmalenbach Business Review (SBR)	1
35	Statistical Journal of the UN Economic Commission for Europe	1
36	WIRTSCHAFTSINFORMATIK	3
37	Zeitschrift für internationale und kapitalmarktorientierte Rechnungslegung	1