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Textual and contextual analysis of professionals' discourses on XBRL data and information quality

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Abstract

Purpose – The purpose of this study is to gain insight into what aspects of eXtensible Business Reporting Language (XBRL) data and information quality (DIQ) most interest professionals.

Design/methodology/approach – The authors use text analytics to examine XBRL discourses from professionals working in the domain. They explore the discussion in the three largest LinkedIn XBRL groups. Data collection covered the period 2010-2016.

Findings – Via the text analytics, the authors find the most appropriate XBRL DIQ dimensions. They propose an XBRL DIQ framework containing 18 relevant DIQ dimensions derived from both the accounting and IS fields. The findings of this study are expected to help direct future XBRL research into the DIQ dimensions most worthy of further empirical investigation.

Originality/value – XBRL is the international standard for the digital reporting of financial, performance, risk and compliance information. Although the expectations of XBRL to produce improvements in DIQ via its applications (e.g. standard business reporting, digital data standard and interactive data visualization) are high, they remain unclear. This paper contributes to better understanding of the aspects of XBRL DIQ most relevant to professionals.

Keywords XBRL, Information quality, eXtensible Business Reporting Language, Data quality

Paper type Research paper

Introduction

The established literature advocates that eXtensible Business Reporting Language (XBRL) be used to support a variety of policies such as transparency, accountability, reducing the administrative burden in financial information disclosures, as well as financial institution supervision and risk management (Liu, 2013; Perdana *et al.*, 2015). Prior studies found that XBRL had positive economic impacts on firms by, for example, reducing the cost of equity capital (Hao *et al.*, 2014), lowering the cost of debt for firms (Lai *et al.*, 2015), and improving forecast accuracy (Liu and O'Farrell, 2013). In the USA, Canada and Asia, XBRL is implemented to improve accountability and transparency of financial statements in capital markets (Callaghan and Nehmer, 2009; Kim *et al.*, 2012; Chen *et al.*, 2016). In Europe, XBRL is used to help enable the activities of banking supervision, risk management, tax administration, data standardization for exchanging business and financial information

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and governance-related filings (Apostolou and Nanopoulos, 2009; Bonson, 2001; Bonson *et al.*, 2009a, 2009b; Guilloux *et al.*, 2013; Troshani *et al.*, 2015). In Australia, XBRL is used to help support the Australian Standard Business Reporting (SBR) instantiation (Piechocki, 2010: Robb *et al.*, 2016). XBRL can, therefore, help improve administrative, financial and accounting processes and reporting for both the private and public sectors.

A substantial number of papers, ranging from conceptual to research papers, has been published in the area of XBRL including its applications, for example, standard business reporting (Robb *et al.*, 2016), digital data standard (Troshani and Lymer, 2010; Guilloux *et al.*, 2013), and interactive data visualization (Janvrin *et al.*, 2014; Locke *et al.*, 2015; Perdana *et al.*, 2018). One of the focuses of XBRL research is to improve the data and information quality (DIQ) of financial information (Yuan and Wang, 2009; Muthusamy *et al.*, 2017). Research has dealt with several DIQ dimensions that XBRL can enhance, such as relevancy, transparency, integrity, credibility, comparability, consistency, understandability, reliability, automated data, and value added (Mejzlik and Istvanfyova, 2008; Yuan and Wang, 2009; Ditter *et al.*, 2011; Vasarhelyi *et al.*, 2012; Muthusamy *et al.*, 2017). In contrast, research has also found that DIQ errors appeared in early XBRL filings. Of the 435 XBRL filings to the US Securities and Exchange Commission (SEC) in 2010, a quarter of them contained calculation errors (Debreceny *et al.*, 2010). XBRL filing errors, however, have decreased since the initial XBRL implementation in the US (Bartley *et al.*, 2011). The decreased error rate of XBRL filings was found to be associated with companies' experiential learning (Du *et al.*, 2013). The above findings indicate that addressing DIQ is critical to the improvement of XBRL developments and implementations.

XBRL research has largely used an accounting information quality framework to evaluate and analyze XBRL DIQ by empirically investigating dimensions such as, ease of understanding, comparability, relevancy, reliability, timeliness, and value added (Hodge *et al.*, 2004; Yuan and Wang, 2009; Arnold *et al.*, 2010; Muthusamy *et al.*, 2017). XBRL can also improve users' experiences when browsing and searching for information and finding relevant material in financial reports (Hodge *et al.*, 2004; Arnold *et al.*, 2010).

Given its multidimensionality, DIQ should be assessed using the attributes of information sources that are relevant to quality (Wang and Strong, 1996). Further, DIQ is inextricably linked to the environment where the data and information are used (McKeating, 1992). This linkage implies that the purpose and the context of the data and information use necessitate different DIQ dimensions. As XBRL intersects both the accounting and information systems (IS) fields, we argue that the applicable DIQ dimensions for XBRL should, likewise, be derived from both the accounting and IS fields.

While prior research in XBRL has derived DIQ dimensions from the accounting and the IS literature, the research evaluated a limited number of XBRL DIQ dimensions (e.g. ease of understanding, value added, and relevancy, reliability, understandability, timeliness and comparability). While DIQ is one of the major concerns arising in professional discourses (Perdana *et al.*, 2015b), there appears to be no specific framework in either the accounting or IS fields for assessing XBRL DIQ. We argue that identifying relevant DIQ dimensions will enable organizations to better undertake DIQ assessments leading to improvements in, and better management of, XBRL development and implementations. As noted by Wang and Strong (1996), DIQ can be improved by understanding which aspects of it most interest its users. Therefore, we contribute by providing a relevant multidimensional DIQ framework for XBRL by incorporating DIQ dimensions from both the accounting and IS fields. This proposed framework can be empirically investigated in future research. In line with the preceding research motivations, we pose the following research questions to help guide our study: *What*

are the applicable XBRL DIQ dimensions? Based on the dimensions we observed, we also seek to uncover *which XBRL DIQ dimensions appeared to remain unresolved*.

In this paper, we propose a framework of XBRL DIQ containing 20 dimensions derived from both the accounting and the IS fields. We contend that this framework has the potential to guide XBRL DIQ improvements and provide an avenue for future empirical research investigating the DIQ dimensions most applicable to XBRL. To address the research question, we conducted an exploratory approach analyzing professionals' discourses in social media. Because *LinkedIn* is the social media platform that attracts most XBRL professionals, we believe that the XBRL-related discussions undertaken in *LinkedIn* groups will best provide representative data for our exploratory study. We began by using two existing DIQ frameworks from both the accounting and IS fields to guide our study. This constituted our preliminary XBRL DIQ framework for which we sourced data derived from textual analysis of professionals' discourses on *LinkedIn* XBRL groups. This data collection occurred at two temporal points: July 2013 and January 2016 and comprised one data set covering January 2011 to mid-2013, and one covering mid-2013 to early 2016. We analyzed and compared both sets using our proposed XBRL DIQ framework to ascertain both the DIQ dimensions that remain constant in professionals' discourses and any differences between the two time periods.

In brief, of the 20 proposed dimensions, our analysis finds eleven DIQ dimensions (i.e. access security, appropriate amount of data, completeness, concise, ease of understanding, interpretability, materiality, objectivity, predictability, prudence, and verifiable) were not topical over the two periods. Six DIQ dimensions (i.e. accessibility, accuracy, comparability, consistency, timeliness, and transparency) were frequently discussed in both data sets, even though the frequency of occurrence of those dimensions varied across time. Three DIQ dimensions: relevancy, value added, and validity, contrasted markedly with relevancy and value added significantly decreasing in frequency in both data sets while validity increased in both.

The structure of this paper is as follows. The next section contains a literature review related to DIQ in the accounting and IS fields, text analytics in social media. Next, the research method including sample data, method and procedures is described. The next sections present the results; discuss the findings; and focus on the contribution, limitations and conclusion.

Literature review

Existing conceptual frameworks of data and information quality

A substantial body of research has been conducted in the IS field in the area of DIQ (Wang and Strong, 1996; Wand and Wang, 1996; Lee *et al.*, 2002; Storey *et al.*, 2012). Data quality refers to data that are fit for use (Wang and Strong, 1996). The terms "Data Quality" and "Information Quality" are often used interchangeably in the literature. Both terms, however, refer to the same referent (Lee *et al.*, 2002; Neely and Cook, 2011). To avoid confusion, we use the term DIQ as proposed by Neely and Cook (2011). This terminology accommodates the notion of quality of both data and information.

Developing, maintaining, and assessing DIQ are among the important themes in IS research (Santhanam and Guimaraes, 1995; Wang and Strong, 1996; Neely and Cook, 2011). Early research into DIQ, for example, attempted to examine the dimensions of DIQ and develop metrics to assess the value of IS' output (Gallagher, 1974; Ahituv, 1980). Four important aspects of DIQ were proposed by Gallagher (1974), namely, relevance, informativeness, usefulness and importance. Further research found that accuracy, timeliness, relevance, aggregation, and formatting are also applicable when measuring information value (Ahituv, 1980). Wang and Strong (1996) conducted notable DIQ research,

whereby they developed a DIQ framework consisting of 15 dimensions: access security, accessibility, accuracy, appropriate amount of data, believability, completeness, concise, consistency, ease of understanding, interpretability, objectivity, reputation, relevancy, timeliness and value added. These 15 were further classified into four categories, intrinsic, contextual, representational, and accessible (Wang and Strong, 1996). Intrinsic DIQ refers to the inherent quality of the information itself (i.e. accuracy, believability, objectivity, and reputation). Contextual DIQ is associated with the fitness of the data and information to support the task being undertaken (i.e. appropriate amount of data, completeness, relevancy, timeliness, and value added). Representational DIQ denotes that the information is easy to understand and process by data consumers (i.e. concise, consistency, ease of understanding, and interpretability), while accessibile DIQ refers to IS' support of data and information security (i.e. access security and accessibility) (Wang and Strong, 1996; Lee *et al.*, 2002). These findings support the notion of DIQ's multidimensionality. Table I present the definitions of Wang and Strong's (1996) DIQ dimensions.

In the accounting field, the underlying concept of DIQ is largely similar to that in the IS field, that is, fitness for use (Neely and Cook, 2011). Accounting information is considered to

Dimension	Definition (adapted from Wang and Strong, 1996)	Categories
Access Security	The extent to which the quantity or volume of available data and information is appropriate	Accessibility
Accessibility	The extent to which data and information are available or easily and quickly retrievable	Accessibility
Accuracy	The extent to which data and information are correct, reliable, and certified free of error	Intrinsic
Appropriate Amount of Data	The extent to which quantity or volume of available data and information is appropriate	Contextual
Believability	The extent to which data and information are accepted or regarded as true, real, and credible	Intrinsic
Completeness	The extent to which data and information are well documented, verifiable, and easily attributed to a source	Contextual
Concise	The extent to which data and information are compactly represented without being overwhelming (i.e., brief in presentation, yet complete and to the point)	Representational
Consistency	The extent to which data and information are always presented in the same format and are compatible with the previous format	Representational
Ease of Understanding	The extent to which data and information are clear, without ambiguity and easily comprehended	Representational
Interpretability	The extent to which data and information are in appropriate language and units and the data definitions are clear	Representational
Objectivity	The extent to which data and information are unbiased (unprejudiced) and impartial	Intrinsic
Relevancy	The extent to which data and information are applicable and helpful for the task at hand	Contextual
Reputation	The extent to which data and information are trusted or highly regarded in terms of their source or content	Intrinsic
Timeliness	The extent to which the age of the data is appropriate for the task at hand	Contextual
Value Added	The extent to which data and information are beneficial and provide advantages for their use	Contextual

Source: Wang and Strong (1996)

Table I. The definition of DIQ dimensions

be useful if it meets the qualitative characteristics of useful financial reporting (IASB, 2015). Based on the conceptual framework for financial reporting issued by International Accounting Standards Board (IASB) (2015), the qualitative characteristics of useful financial reporting are formed from 11 DIQ dimensions. Two core qualitative characteristics are relevance and faithful representations. One DIQ dimension, that is materiality, supports the relevance of financial reporting, while four DIQ dimensions (i.e. complete, neutrality, prudence, and free from errors) support the faithful representation of financial reporting. Financial information usefulness is further enriched when the information is comparable, verifiable, timely and understandable (IASB, 2015).

DIQ dimensions in the IS field are applicable to accounting. In addition, because of their importance to decision making, they also play critical roles. Those dimensions include accuracy, completeness, ease of understanding, relevance and timeliness. Those DIQ dimensions also form part of the qualitative characteristics of financial reporting in the accounting standards of the International Accounting Standard Board (IASB). The notion of DIQ in accounting, therefore, largely mirrors the concept of DIQ in the IS field. Table II presents the DIQ dimensions derived from IASB's qualitative characteristics of financial reporting.

Dimension	Definition	Categories
Relevance	The extent to which data and information are capable of affecting decision making	Core qualitative characteristics of useful financial reporting
Materiality	The extent to which data and information affect decision making when the data or information are omitted or misstated	Component of relevance
Faithful representations	The extent to which data and information represent an economic phenomenon	Core qualitative characteristics of useful financial reporting
Complete	The extent to which data and information are well depicted with all necessary depictions and explanations	Component of faithful representations
Neutrality	The extent to which data and information are free from bias, and free from favorable and unfavorable manipulation	Component of faithful representations
Prudence	The extent to which data and information are provided with cautions	Component of faithful representations
Free from errors	The extent to which data and information are free from errors or omissions of description and explanation	Component of faithful representations
Comparable	The extent to which data and information enable decision makers to understand and to identify similarities and differences	Additional qualitative characteristics
Verifiable	The extent to which data and information can be proved as correct when presenting the economic phenomena	Additional qualitative characteristics
Timely	The extent to which data and information are available for decision makers in time and appropriate to influence decision making	Additional qualitative characteristics
Understandable	The extent to which data and information are readily comprehended	Additional qualitative characteristics

Table II.
The DIQ dimensions based on IASB (2015)

eXtensible Business Reporting Language and social media

Since the development of XBRL in 1998, a substantial body of XBRL-related information has been readily accessible via the Internet. Indeed, several efforts have been made to disseminate XBRL knowledge globally, such as XBRL International Inc. (XII), which provides XBRL information that can be accessed via www.xbrl.org. This website provides a significant body of XBRL materials, including articles, case studies, conference presentations, magazine, and white papers. Additionally, individuals can easily locate online XBRL communities such as in XBRL public forums, XBRL news feeds, blogs, and social media. Materials in the XBRL communities are varied, ranging from describing the impact of XBRL on business, to the technical aspects of XBRL.

Online XBRL communities, particularly in social media, can positively affect XBRL information diffusion. The spread of social media has also created a valuable avenue for XBRL knowledge sharing. Accessing XBRL information via websites usually affords one-way interaction, whereby people simply read the available articles without the opportunity to share their thoughts, to query domain experts, or to respond to others' opinions. Social media, however, appears to address those matters. Social media connects individuals from different locations around the world to interact and to share knowledge across geographical boundaries (Lee and Ma, 2012; Stewart, 2012).

XBRL information can be found on social media outlets such as *Twitter*, *Facebook*, *Google+*, and *LinkedIn*. XBRL vendors and prominent individuals in the XBRL development community have a presence on *Twitter* where they share updates and XBRL related links. While XBRL information can be found on, and through *Twitter*, it does not provide a platform for individuals to engage in group discussions. We found several XBRL focused pages on *Facebook*. Some pages did not contain discussions nor updated information about XBRL, while others had discussions, but the information posted appeared to overlap with those in the *LinkedIn* groups. We also found that the XBRL groups on *Facebook* engaged in fewer discourses than XBRL groups on *LinkedIn*. Although several XBRL focused pages and groups on *Google+* also post and share XBRL related information, community discourses about XBRL on *Google+* remain very limited. *LinkedIn* provides the most relevant XBRL information via *LinkedIn* XBRL groups, whereby *LinkedIn* members can engage in continuing discourses, share their experiences, and enter discussions with XBRL professionals. Further, members can trace XBRL information on *LinkedIn* XBRL groups. *LinkedIn* is an example of social media, therefore, that provides opportunities for individuals who are appropriately interested in XBRL to engage in discussion.

Text analytics in social media

The richness of text data in social media provides researchers with the opportunity to analyze the context of the data by clustering, predicting, and investigating data relationships. Access to this real-world data helps researchers more rapidly investigate questions compared to traditional data collection methods, like experiments, surveys, interviews, or focus discussion groups. Conversation in social media occurs naturally without guidance or treatment relative to how individuals interact with each other. In addition, social media data are freely available to collect. This type of data, therefore, can help mitigate bias, either from the researchers themselves or from social media users *per se* (Mostafa, 2013).

Social media interaction generally occurs via written text in the form of posted links, images, notes or comments. Such interactions have created a large body of data that researchers can exploit to uncover hidden patterns that may exist within the data. Social media data, however, has three notable characteristics, they are large, noisy and dynamic

(Mostafa, 2013). These characteristics of social media make these data useful as well as challenging. Research into social media provides opportunities for exploring particular problems deeply using big data that previously were almost impossible to obtain. Noisy and dynamic characteristics can, however challenge researchers. Noisy data, such as frivolous comments together with problematic syntactical and lexical postings, can potentially affect the pattern of the data (Mostafa, 2013; Barbier and Liu, 2011). In addition, intense interactions among social media users can lead to rapid changes in the topic of conversation. Researchers thus need to consider the time component when investigating such dynamic data (Barbier and Liu, 2011).

While social media data are rich, they are mostly unstructured. Researchers need to use text analytics to help enable meaningful information to be discovered within social media data, such as by ascertaining the value of social media data in tracking public opinion toward particular brands (Mostafa, 2013) or developing a framework to cluster emerging topics or events in social media (Lee, 2012). Social media not only provides promising data for research, but also enables researchers to investigate the meaning of the data as emerges from within their context. Further, how those particular data relate to other data and human behavior can be investigated. These conclusions emphasize the importance of text analytics to obtain valuable information from social media.

Research method

Sample data

We used the data obtained from *LinkedIn* XBRL communities to gain insight into professionals' views or concerns about XBRL DIQ. XBRL communities, particularly in social media, can provide useful information about XBRL implementation. Recall that social media permit individuals from different geographical locations to interact online and to share knowledge across national borders (Lee and Ma, 2012; Stewart, 2012). By mid-2013, we observed that there are 89 *LinkedIn* groups related to XBRL and, as such, appears to be suitable for obtaining data relative to XBRL topics, particularly, those related to DIQ. We used two keywords, namely, "XBRL", and "eXtensible Business Reporting Language" to identify the appropriate groups. We included the three largest groups with the highest level of interactivity.

We first observed and conducted data collection from the three largest and most interactive XBRL discussion groups on *LinkedIn* at the beginning of June 2013 and, to accommodate changes in XBRL mandates, instantiations, and developments, we obtained additional data for the second data collection in January 2016. We used the three largest *LinkedIn* XBRL groups as the sample data. During the first data collection the three largest groups were identified by counting the group member numbers and assessing their interactivity levels compared with other existing LinkedIn XBRL groups. The identification was conducted by comparing all LinkedIn XBRL groups using the (then) LinkedIn posts and comments graphing feature (see Figure 1). Our analysis found that *XBRL*, *XBRL Knowledge Sharing,* and *XBRL Interactive Network* were the three largest and most interactive XBRL groups on *LinkedIn* during the 25-29 June 2013 data collection period.

We captured all discussion materials (i.e. posts, comments, and links) within the three groups using *NCapture*. The coverage of data collection was, however restricted by *LinkedIn's* algorithm. Consequently, data collection occurred during the time ranges permitted by *LinkedIn*. During the data collection timeframes, we found that professionals' discourses were concerned about XBRL information diffusion and implementation. The discourses also featured the professionals who were pursuing enhancements to XBRL DIQ (Perdana *et al.*, 2015b). Following this rationale, we contend that this data set can provide

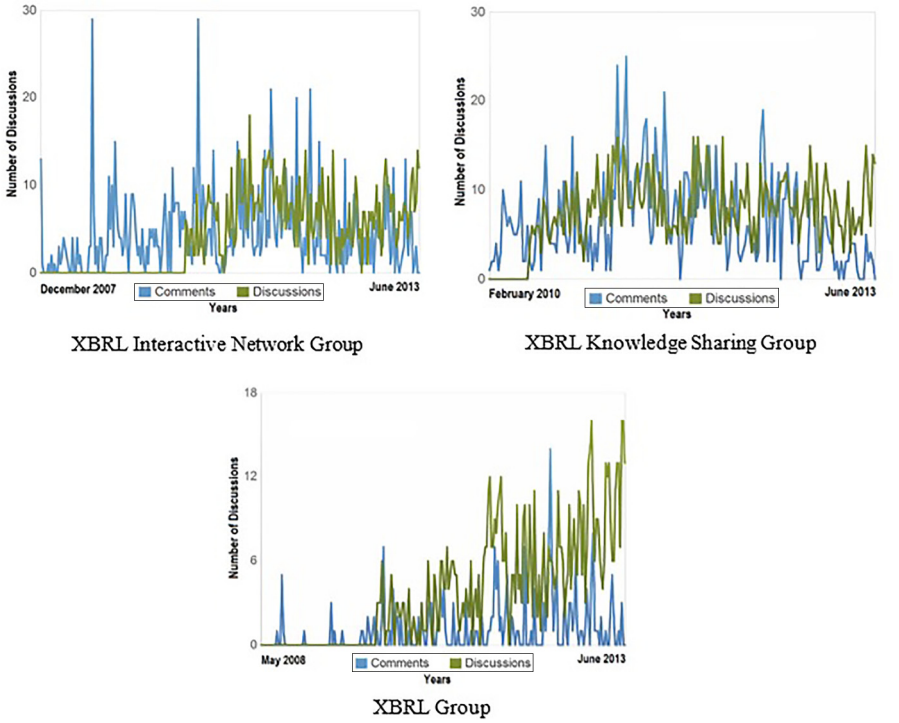

Figure 1. XBRL LinkedIn groups' comments and discussion

insightful findings relative to the XBRL DIQ dimensions that most interest professionals. The data capture produced the data sets as presented in Table III.

Method and procedures

Users' conversations and interactions in social media provide a rich body of data. Text analytics is useful for addressing specific issues such as keyword searching, classification, and clustering (Aggarwal and Wang, 2011). We applied text analytics techniques to help uncover XBRL DIQ dimensions of most interest to professionals working in the domain. The professionals' posts and comments within the three focal XBRL groups on *LinkedIn* were analyzed using *NVivo* to help us derive findings from the textual data. We conducted data pre-processing to ensure that the unstructured data from *LinkedIn* could be further analyzed and to avoid irrelevant output in our analysis. The data preprocessing included extraction and preparation. We extracted all text data in tabular format, removed all URL links, and excluded distinguishing data. We prepared the data in a word processing application to ensure that the data was compatible with NVivo. Prior to the analysis, we proposed a preliminary framework to help guide our text analysis. We incorporated all DIQ dimensions from the accounting and the IS literature to develop this preliminary framework. We used Wang and Strong's (1996) definition of DIQ for the dimensions related to the IS literature, and IASB's definition of DIQ for the dimensions related to the accounting literature. Table IV presents the preliminary framework for the DIQ analysis.

We used the preliminary framework presented in Table IV to guide the query searches and word occurrence analyses using NVivo. We undertook two stages of analyses. First, we

Table III.
Sample data sets

Data sets	Data Set 1 (collected 25 to 29 June 2013) covering the periods below		Data Set 2 (collected 27 to 30 January 2016) covering the periods below	
	Total Numbers	Discussion Period	Total Numbers	Discussion Period
XBRL Interactive Network	378 unique posts and 484 unique comments	2 July 2011 to 29 June 2013	188 unique posts and 134 unique comments	20 May 2014 to 30 January 2016
XBRL Knowledge Sharing	379 unique posts and 568 unique comments	28 March 2012 to 29 June 2013	148 unique posts and 22 unique comments	27 August 2013 to 30 January 2016
XBRL	434 unique posts and 220 unique comments	12 May 2010 to 29 June 2013	138 unique posts 32 unique comments	13 August 2013 to 30 January 2016

DIQ Framework in IS (Wang and Strong, 1996)	DIQ Framework in Accounting (IASB, 2015)	Preliminary DIQ Framework for XBRL
Access Security		Access Security
Accessibility		Accessibility
Accuracy	Free from errors	Accuracy
Appropriate amount of data		Appropriate amount of data
Believability		Believability
Completeness	Complete	Completeness
Concise		Concise
Consistency		Consistency
Ease of understanding	Understandability	Ease of understanding
Interpretability		Interpretability
Objectivity		Objectivity
Relevancy	Relevance	Relevancy
Reputation		Reputation
Timeliness	Timeliness	Timeliness
Value added		Value added
	Comparability	Comparability
	Faithful representation	Faithful representation
	Materiality	Materiality
	Neutral	Neutrality
	Prudence	Prudence
	Verifiable	Verifiable

Table IV. Preliminary XBRL DIQ framework

conducted the word frequency analysis to help uncover words that frequently appeared in the data and that were related to the preliminary framework. We were cognizant of the possibility of uncovering DIQ dimensions from the data we had not anticipated. Second, we refined the preliminary framework based on the results of our first analysis. To further investigate the relevancy of the dimensions, we undertook content analysis for each unique post examining the conversations where the texts appeared. The frequency of word occurrences within unstructured data reflects public opinion toward particular topics (Mostafa, 2013). Uncovering such patterns helps us to understand how people conceive and perceive XBRL DIQ. We coded the data based on our proposed framework. This coding analysis is necessary to help understand the context of the DIQ dimensions in the *LinkedIn* XBRL discussion groups. By incorporating the findings from the two data collections and the analyses, we then examined the dimensions consistently appearing in the professionals' discourses relative to XBRL DIQ.

Findings

Four words, believability, faithful representation, neutrality and reputation did not appear in either data set and as such were excluded from further discussion. The first analysis revealed 17 words related to the preliminary DIQ framework. We used the word, specialization, in the analysis to extend our search for all possible meanings. The analysis, therefore, counted not only the occurrences of the dimensions' exact word, but also similar words or synonyms associated with the particular dimension. The results of the dimensions' word frequency query from both the first and second data sets yielded 962 and 958 words, respectively. We carefully investigated those words and, where possible, matched them with the preliminary XBRL DIQ framework. The word frequency count for the DIQ framework terms and any related words/concepts are presented in Table V.

Table V. Concepts related to the preliminary DIQ framework for XBRL

DIQ Dimension Framework for XBRL	Related words	Data set 1 (Count)	Data set 2 (Count)
Access Security	Security	2	0
Accessibility	Available	520	616
	Access	228	262
Accuracy	Accurate	308	268
	Errors	327	230
Appropriate amount of data	Appropriate	279	266
	Sufficient	44	27
	Enough	62	40
Believability	–	0	0
Comparability	Comparable	114	87
	Comparison	177	128
Completeness	Complete	562	396
Concise	–	0	1
Consistency	Consistent	118	218
	Seamless	0	81
Ease of understanding	Understand	1,791	1,412
Faithful representation	–	0	0
Interpretability	–	5	3
Materiality	–	1	0
Neutrality	–	0	0
Objectivity	–	1,584	1,037
Prudence	–	1	0
Relevancy	Relevant	141	88
Reputation	–	0	0
Timeliness	Time	565	606
Value added	Value	23	0
Verifiable	–	552	393

Aside from finding words similar to those in the preliminary DIQ framework, we also uncovered three additional words appearing as DIQ-related dimensions. These words are, predictable, transparent, and validation. We classified these words into the DIQ dimensions, predictability, validity, and transparency. Table VI shows the DIQ-related dimensions and words not in the preliminary DIQ framework.

Since the frequency of word occurrence may not provide a clear understanding of the context of the sample data, we conducted coding analysis to help address this matter. Based on the preliminary XBRL DIQ framework (after removing those words which did not appear in either data set) and including the emergent DIQ-related dimensions from the first analysis, we refined the preliminary framework and proposed the following XBRL DIQ framework containing 20 dimensions. A Framework for XBRL DIQ Dimensions presents our proposed framework for DIQ dimensions.

DIQ Dimensions:

(1) access security;
(2) accessibility;
(3) accuracy;
(4) appropriate amount of data;
(5) comparability;
(6) completeness;

(7) concise;
(8) consistency;
(9) ease of understanding;
(10) interpretability;
(11) materiality;
(12) objectivity;
(13) predictability;
(14) prudence;
(15) relevancy;
(16) timeliness;
(17) transparency;
(18) validity;
(19) value added; and
(20) verifiable.

Using the DIQ dimensions contained in the framework as our selective coding scheme, we conducted text query searches. We examined each post and comment containing the discourses related to the dimensions. Our analysis found that word frequency alone was not necessarily a true indicator of relevance in a DIQ-related context. For example, the frequencies of the word *understand*, its synonyms, and its specialized words are 1,791 and 1,412, for data collections 1 and 2, respectively. However, we found only three posts in the first data set and two posts in the second data set containing the word *understand* that were directly associated with DIQ. In contrast, the number of occurrences of the words *accurate* and *errors* was smaller than the word *understand*, accounting for 308 and 327 (first data set), 268 and 230 (second data set), respectively. These two words, however, frequently appeared in the professionals' discourses such that they were directly related to XBRL DIQ. In the first and second data sets, 142 and 69 references appeared relative to *accuracy* associated with DIQ. Table VII presents the result of the coding analysis of the DIQ dimensions.

Discussion

Our coding analysis found more than five references in both data sets for the six DIQ dimensions, namely, accessibility, accuracy, comparability, consistency, timeliness, and transparency. Given these dimensions are central to XBRL DIQ, frequent discussion of these DIQ dimensions presents little surprise as the following explains. First, the ability of XBRL to solve incompatibilities between different systems was expected to enhance the availability and accessibility of financial information to investors.

Second, accuracy was the most common topical conversation appearing within the *LinkedIn* XBRL discussion groups within both data sets. Since errors were found in the early

Table VI. DIQ-Related words not in the preliminary DIQ framework

Dimension	Related words	Data collection 1 (Count)	Data collection 2 (Count)
Predictability	Predictable	76	1
Transparency	Transparent	137	111
Validity	Validation	468	311

Table VII. DIQ Dimensions and the number of references

DIQ Dimensions	Data collection 1	Data collection 2
Access security*	2	0
Accessibility**	36	18
Accuracy**	142	69
Appropriate amount of data*	0	0
Comparability**	36	21
Completeness*	2	4
Concise*	0	1
Consistency**	26	41
Ease of understanding*	3	2
Interpretability*	5	3
Materiality*	1	0
Objectivity*	0	1
Predictability*	1	1
Prudence*	1	0
Relevancy	11	1
Timeliness**	8	9
Transparency**	38	16
Validity	4	30
Value Added	23	0
Verifiable*	0	0

Notes: *DIQ dimensions appeared ≤ 5 times in both data sets; **DIQ dimensions appeared >5 times in both data sets

SEC XBRL filings, accuracy was seen to captivate XBRL professionals (Debreceny *et al.*, 2010; Bartley *et al.*, 2011). Professionals were concerned with improving XBRL's accuracy and addressing XBRL errors.

Third, XBRL was generally expected to improve the comparability and the consistency of financial statement disclosures. Comparability and consistency have remained basic to XBRL discourses (Piechocki *et al.*, 2009; Debreceny *et al.*, 2011; Dhole *et al.*, 2015; Perdana *et al.*, 2015a, 2015b). Taxonomy extensions have created tradeoffs, however, between flexibility and comparability in XBRL-based financial statements. On the one hand, XBRL taxonomies have to address the specific needs of particular industries when disclosing their financial statements. Conversely, these taxonomies appear to inhibit the comparability of financial statements between different industries (Rao *et al.*, 2013). Kaya (2014) suggests that a taxonomy based on IFRS or US-GAAP that can be extended with additional localization and firm-specific supplements can potentially accommodate standardization requirements and improve cross-sectional comparability.

Fourth, timeliness and transparency were considered important to XBRL DIQ. Professionals expected that the use of XBRL would help them to more readily find information for their accounting and auditing purposes. While accessibility, accuracy, comparability and transparency remain topical, their frequency of appearance has reduced across time. This decrease suggests that the issues concerned with these DIQ dimensions are being addressed and resolved.

We found that three DIQ dimensions (i.e. relevancy, validity, and value added) appeared irregularly in both data sets with references in the data sets to two of them (relevancy and value added) substantially decreasing. While relevancy had more than 11 references in the first data set, they decreased by about a tenth in the second data set. This decrease suggests

that professionals increasingly accept that XBRL-enabled financial statements are capable of providing appropriate financial information that is fit for purpose. While value-added had 23 references in the first data set, the references decreased to zero in the second. As XBRL has matured, its effectiveness has been confirmed, and its uptake has expanded across purposes[1] and jurisdictions, the value added benefit is no longer queried. Accordingly, no references to value added were found in the second data set.

While validity had less than five references in the first data set, it was referred to 30 times in the second. Comparing validity with accuracy produced notable results. While the frequency of accuracy decreased by half, the frequency of validity increased by about one sixth. This shift from accuracy to validity suggests that this disparity results from XBRL professionals' expectations of acceptable error rates (i.e. the quality of being valid) and the reduced actual error rates in XBRL-enabled financial statements (i.e. increased accuracy).

Eleven DIQ dimensions, i.e. access security, appropriate amount of data, completeness, concise, ease of understanding, interpretability, materiality, objectivity, predictability, prudence, and verifiable had five or fewer references in both data sets. Such low frequencies suggest that these dimensions were not topical or relevant to the professionals over the two data collection periods.

Table VIII (Panel A) displays the representative posts and comments as references related to the six XBRL DIQ dimensions that appear consistently and have more than five references in both data sets. Table VIII Panel B shows those representative posts and comments as references related to the three XBRL DIQ dimensions that appear irregularly in both data sets.

As we noted in the Findings section, simply analyzing the word frequencies to identify XBRL DIQ dimensions does not necessarily reveal the nuances of the data. We therefore used the results from the text analytics as the basis to further analyze the context in which the words appeared within the discussions. Based on our findings, we refined our preliminary XBRL DIQ framework. We propose that the words that have references in the sample data guide identification of the most salient XBRL DIQ dimensions. After analyzing the context in which the words appeared, we identified 18 DIQ dimensions that have references in either first or second data sets[2], i.e. *access security, accessibility, accuracy, comparability, completeness, concise, consistency, ease of understanding, interpretability, materiality, objectivity, predictability, prudence, relevancy, timeliness, transparency, validity* and *value added*. Two DIQ dimensions, *appropriate amount of data* and *verifiable* have no references in either data set, leading us to believe that the professionals did not find these two dimensions applicable for assessing XBRL DIQ.

Of the 18 XBRL DIQ dimensions, we observed increasing and decreasing word frequencies in the data sets. Eleven XBRL DIQ dimensions, i.e. *access security, accessibility, accuracy, comparability, ease of understanding, interpretability, materiality, prudence, relevancy, transparency,* and *value added* had declining word counts in the second data set compared with the first data set. Seven XBRL DIQ dimensions, namely, *completeness, concise, consistency, objectivity, timeliness,* and *validity*, appeared to have increasing word counts in the second *LinkedIn* XBRL groups' data set compared to the first data set. The increasing word frequencies for certain XBRL DIQ dimensions from the first to the second data sets may indicate that these dimensions remain unresolved, stimulating continuing discussion among the professionals. Reducing word frequencies for other XBRL DIQ dimensions over time likely indicates dimensions that were of declining importance to the professionals.

Of the 18 DIQ dimensions, six of them, *accuracy*, *comparability*, *completeness*, *ease of understanding*, *timeliness*, and *relevancy* are consistent with the main qualitative

DIQ Dimensions	Representative sample posts and comments
Panel A - XBRL DIQ dimensions that appear consistently and have more than five references in both data sets	
Accessibility	"Filers should spend the effort they are investing in attempting to destroy the SEC's XBRL regulation on improving the quality of their own data, as well as on making their own data more useful and accessible to users"
	"Recently, our team of engineers has been working on new ways to analyze and make eXtensible Business Markup Language (XBRL) even more accessible and useful for the common investor. During these brainstorming sessions, it occurred to us that the standard has a rather limiting attribute that can be expanded to vastly improve XBRL's accessibility"
Accuracy	"It [XBRL] is being put to practical use in a number of countries and XBRL implementations in increasing numbers. In the process XBRL is proving its benefits in increasing the efficiency, the speed, the accuracy and the transparency of financial reporting"
	"As you consider removing the XBRL mandate for a significant portion of public companies, please consider how such a move could be detrimental to investors over the long run. Tomorrow's investors will demand accurate information from the companies they've entrusted with their capital
Comparability	"I heard that China does not allow companies to have extensions (I may hear it wrong, if you know please verify this), which makes it relatively easy to compare financial statements between companies; In contrast, the US allows companies to create extensions, and indeed, companies create a lot of extensions, thus comparability becomes a huge issue partly because of extensions"
	"All proposed extensions of XBRL Concepts should be send across to FASB right away for approval and if FASB approves it is automatically in the Taxonomy and thus not an extension any more to facilitate comparability. Thus we will hav e a XBRL Reporting Taxonomy updated in Real Time to increase comparability
Consistency	"The purpose of XBRL is to enhance comparability and consistency of disclosures within a company, across industry and over time
	"The reason is that the rule specifies allowed relations. Public company XBRL-based financial reports are expected to be consistent with those machine-readable (also human-readable) and machine-interpretable rules
Transparency	"The XBRL data standard is in widespread use by public companies today, making data computer-readable, more transparent, accurate and timely. XBRL could improve corporate actions processing by eliminating the need for manual rekeying and scrubbing of data
	"The Commission is committed to using developments in technology and electronic data communications to facilitate greater transparency in the form of easier access to, and analysis of, information
Timeliness	"I don't see that the XBRL community understands the importance of timeliness. Nor does the community understand the importance of applications. Without timely XBRL data and XBRL apps that really are useful to investors, XBRL fails
	"After collecting all the filers' business information in XBRL, organizations need to meet the growing demand for timely and accurate analysis and mining of these filings
Panel B - XBRL DIQ dimensions that appear irregularly in both data sets	
Relevancy	"XBRL is ideally poised to take up that role such that businesses, governments, auditors and investors can have relevant real time information and systems can communicate with each other without having to worry about major software changes
	"The taxonomy will be used when tagging charity accounts for electronic filing and for other analytical purposes. Electronic tagging helps users of financial information to extract relevant information from corporate reports and analyze it more efficiently

(*continued*)

Table VIII. Representative sample posts or comments related to XBRL DIQ dimensions

DIQ Dimensions	Representative sample posts and comments
Validity	It's interesting. I wonder how many mistakes there were in SEC filings before the advent of XBRL? 15,000 lines in the US-GAAP taxonomy. It's a big job. But I also wonder why so many errors are getting through XBRL engines that are supposed to check the validity of submissions. Having said that it looks like extensions are to blame for a lot of the errors
	In all three cases the tool will validate the data and generate the XBRL file, which can then be delivered to the NCA. The validation process will flag up any errors, for example if the sum of balance sheet items doesn't match up with the totals
Value Added	Many have doubts about the real value of XBRL filings. Some argue that the reason is the lack of XBRL-based applications, and the reason of that is the lack of XBRL data. The value of XBRL makes intuitive sense. I'm interested to watch and see what tangible results come of it over the next few years

Table VIII.

characteristics of financial reporting (i.e. *materiality*, *prudence*, *relevance* and *faithful representations*), as well as the additional DIQ dimensions important for enhancing the usefulness of financial reporting (Table II). Three dimensions: *comparability*, *ease of understanding* and *timeliness* are consistent with the qualitative characteristics that enhance the usefulness of financial information. Apart from being consistent with the qualitative characteristics of financial information, the above six DIQ dimensions as well as the dimensions: *access security*, *accessibility*, *concise*, *consistency*, *objectivity*, *interpretability* and *value added* are also consistent with IS DIQ frameworks (Table I). The remaining DIQ dimensions: *predictability*, *transparency*, and *validity* were DIQ dimensions that emerged from the professionals' discourses.

Contribution, limitations and conclusion

Social media like *LinkedIn* provide rich and accessible data to better understand particular topics. Further, because many XBRL practitioners and academics are involved in *LinkedIn* groups, discussions help to advance our understanding of current issues in XBRL. As an exploratory study, our findings provide insight into the proposed framework for the DIQ dimensions that are most applicable to XBRL, and which most interest XBRL professionals. As the technology, its uses, and its acceptance evolve, future research may use our framework for XBRL DIQ to empirically investigate whether or not our proposed DIQ dimensions remain appropriate for XBRL. As no extant research appears to assess XBRL DIQ, further research in this field is warranted and essential for promoting the further development and implementation of XBRL.

We are aware that this study has limitations. The data we obtained from the social media, that is, the *LinkedIn* XBRL groups, are noisy and dynamic (Barbier and Liu, 2011). Our data pre-processing also established that link posting in the sample data made the data noisy and inhibited analyses of the data both for word frequency and content analysis. In addition, as dynamic conversations occur in *LinkedIn*, the word frequency and content analysis in our study may be influenced either positively or negatively. As we noted, above, professional expectations relative to particular DIQ dimensions may change as a result of XBRL improvements, developments, and implementations.

Overall, this study has addressed the research question "What are the applicable XBRL DIQ dimensions?" We contend that the integration of DIQ frameworks from both the accounting and the IS fields applies to the assessment of XBRL DIQ dimensions. Based on

this contention, we proposed a framework containing 18 XBRL DIQ dimensions. Of these, our analysis found that professionals were consistently discussing five DIQ dimensions derived from the accounting and the IS fields (i.e. accessibility, accuracy, comparability, consistency and timeliness) and one (transparency) emerging from the professional conversations on *LinkedIn* XBRL groups. Two dimensions (i.e., value added and relevancy) have decreased in topic importance. In contrast, validity increased in topic importance as the XBRL technology has matured.

Following the first research question, we address the second research question: *which XBRL DIQ dimensions appeared to remain unresolved*? We investigate the increasing word frequency in the second compared with the first dataset. Seven XBRL DIQ dimensions, *completeness, concise, consistency, objectivity, timeliness* and *validity*, had increased word frequency in the second data set compared with the first data set. This increase suggests that these dimensions remain unresolved for XBRL professionals. Our content analysis helps ensure that our proposed framework is relevant to assess XBRL DIQ. The analysis also illustrates the importance of constantly reexamining the areas of DIQ that are crucial to a technology at a point in time as the relative weighting of DIQ factors quite likely vary across time.

Notes

1. For example, single purpose instantiations such as the US SEC's Interactive Data Filing or multi-purpose instantiations such as The Netherlands' Standard Business Reporting (SBR).
2. Recall, data set 1 was collected over the period 25-29 June 2013 covering periods from May 2010 to June 2013 and data set 2 was collected over the period 27-30 January 2016 covering periods August 2013 to January 2016.

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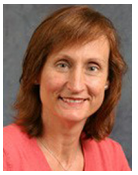

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