THE IMPACT OF DATA INFORMATION QUALITY OF XBRL-BASED FINANCIAL STATEMENTS ON NONPROFESSIONAL INVESTORS’ DECISION MAKING

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Abstract

XBRL has the ability to provide financial statements with improved data information quality (DIQ). Contextual and representational DIQ are relevant to perceptual and decision factors of nonprofessional investors when they interact with XBRL-based financial statements and make investment decisions. The author posits that XBRL-based financial statements with improved contextual and representational DIQ will positively influence nonprofessional investors’ DIQ perceptions, resulting in better alignment with decision factors (i.e., uncertainty, heuristic, task, technology, and individual characteristics) to achieve better informed investment decisions. This research will use a web-based experiment to empirically test the proposed hypotheses. The results of this research are expected to contribute to the theoretical understanding of the links between XBRL enhanced DIQ, users’ perceptions, decision factors, and investment outcome performance. Establishing whether there are links between XBRL and improved DIQ, and whether improved DIQ aligns with decision factors, will make a practical contribution by benefiting nonprofessional investors through better informed investment decisions.

Keywords: eXtensible business reporting language, XBRL, data information quality, investment decision making, nonprofessional investors.
1 INTRODUCTION

Preparation, presentation and distribution of companies’ financial statements are inextricably linked with information systems and technology (Hall, 2011; Bagranoff, Simkin & Norman, 2011). Difficulties with processing and transforming transactions into financial statements arising from system compatibility, presentation requirements, and timely distribution can be solved by utilising information technology (IT). Extensible business reporting language (XBRL) has developed over the last decade and can help overcome such problems. XBRL is a universally accepted computer markup language that allows different information systems to communicate easily (Hoffman & Watson, 2010), produce multiple and interactive financial statements’ formats, and support the timely distribution of those statements (Debreceny & Gray, 2001; Baldwin, Brown & Trinkle, 2006).

Aside from providing benefits to companies managing financial statements, XBRL also helps financial statement users’ enhance their ability to evaluate and analyse financial data as well as helping support their decision making performance (Scarlata, 2009). Academics and practitioners alike recognize XBRL’s potential to benefit financial statement users (see., e.g. Baldwin et al., 2006; Tribunella & Tribunella, 2010; Alles & Debreceny, 2012). These benefits arise from XBRL’s capabilities to enhance data information quality (DIQ) via reducing information asymmetry, improving information accuracy, transparency, and timeliness (Strand, 2001; Graziano, 2002; Willis & Sinet, 2008; Pinsker & Li, 2008; Kim, Lim, & No, 2012). In addition, XBRL-based financial statements permit users to choose their preferred financial statement format, to directly search for information, to compare financial statements from different companies, to display information concisely, and to present information via graphical representations (see, e.g., Hodge, Kennedy & Maines, 2004; Pinsker & Wheeler, 2009; Taylor & Dzuranin, 2010; Arnold, Bedard, Phillips, & Sutton, 2012).

The author contends that XBRL equips financial statements with contextual and representational DIQ. Contextual DIQ confirms users’ expectation of retrieving and interpreting financial information (Park & Kim, 2000; Lee, 2010), while representational DIQ aligns financial information with users’ cognitive processing (Vessey, 1991). These two dimensions of DIQ can lead to better information acquisition and, thus, better informed investment decisions (Jung, 2005). Even though prior research has attempted to link XBRL-based financial statements to improved DIQ (see, e.g., Bovee, Ettredge, Srivastava, & Vasarhelyi, 2002; Hwang, Leem & Moon, 2008; Pinsker & Wheeler, 2009; Roohani, Furusho & Koizumi, 2009; Yingchun & Baohua, 2010; Yoon, Zo & Ciganek, 2010) and investigated the impact of XBRL on investment decision making (see, e.g. Scarlata, 2009; Arnold et al., 2012), questions still arise in relation to the links between XBRL, DIQ, decision factors and investment decision making. For example, how is the DIQ of the XBRL-based financial statements perceived by users, how do those statements influence decision factors and facilitate better performance when making investment decisions, and do such statements influence the willingness to invest? These questions warrant investigation. How nonprofessional investors process financial information is indicated by an increasing body of research in this area (see, e.g., Elliott, Hodge, Kennedy, & Pronk, 2007; Jurney, 2008; Pitre, Daigle & Pinsker, 2009; Pinsker & Wheeler, 2009; Coram, 2010; Pinsker, 2011; Pitre, 2012; Arnold et al., 2012). Capital market authorities are also interested nonprofessional investors (Juney, 2008). This research will focus on how nonprofessional investors interact with XBRL-based financial statements and the manner in which the DIQ affects nonprofessional investors’ performance when making investment decisions.

Drawing on DIQ literature, transaction cost analysis (TCA), heuristic processing literature, and the task, technology, fit (TTF) theory, this research attempts to analyse users’ perceptions of XBRL-based financial statements’ DIQ. In particular, this research will investigate the impact of XBRL interactive financial statements on investment outcome performance (i.e., decision time, investment tasks accuracy, and willingness to invest) and whether there is an alignment between XBRL interactive financial statement, decision making factors (i.e., uncertainty, heuristic processing, task characteristics, technology characteristics and individual characteristics), and investment outcome performance. TCA provides a framework to analyse both the capabilities of XBRL-based financial statements and DIQ’s
ability to reduce uncertainty. XBRL’s impact on decision making performance and the ability to overcome the limitations of human information processing is examined from a heuristic information processing perspective. Finally, TTF is employed to uncover possible links between nonprofessional investors’ individual characteristics, investment tasks, and XBRL technology with DIQ to produce better informed investment decisions.

The remainder of this submission proceeds as follows. Section 2 reviews relevant prior studies and develops the hypotheses. Section 3 describes the research methods. Section 4 identifies future work, and finally, section 5 presents conclusions.

# 2 PRIOR RESEARCH AND HYPOTHESES DEVELOPMENT

## 2.1 Extensible Business Reporting Language (XBRL) and Data Information Quality (DIQ)

Over the past decade, XBRL research has appeared in academic publications (see, e.g., Rezaee, Elam & Sharbatoghlie, 2001; Malhotra & Garritt, 2004; Du & Roohani, 2007; Callaghan & Nehmer, 2009; Bonson, Cortijo, Escobar, Monreal, & Flores, 2010; Arnold et al., 2012). Additionally, several regulatory bodies and capital market authorities have encouraged (and required) the implementation of XBRL-based financial report filing. Generally, research and implementations of XBRL indicate that XBRL generates advantages to both financial information providers and users, allowing easier interaction with, and communication of, information to both parties. In addition, XBRL advocates claim XBRL delivers benefits to the accounting value chain, promotes the improvement of DIQ, and improves users’ performance in decision making (Strand, 2001; Graziano, 2002; Willis & Sinet, 2008; Pinsker & Li, 2008; Scarlata, 2009).

The ability of XBRL to provide searchable and understandable financial statement formats leads to improvements of the DIQ. This argument aligns with the definition of DIQ, that is, the fitness of the data for users’ needs (Neely & Cook, 2011). A substantial body of research in the area of DIQ has resulted in the identification of different dimensions of DIQ (see, e.g., Gallagher, 1974; Ahituv, 1980; Iivari & Koskela, 1987; Wang & Strong, 1996; Wand & Wang, 1996). Wang & Strong’s (1996), study proposed fifteen DIQ dimensions; namely, believability, accuracy, objectivity, reputation, value added, relevancy, timeliness, completeness, appropriate amount of data, interpretability, ease of understanding, representational consistency, concise representation, accessibility, and access security. Wang & Strong further classified these fifteen dimensions of DIQ into four categories: intrinsic, contextual, representational, and accessibility. Intrinsic DIQ refers to the inherent quality of the information itself (i.e., believability, accuracy, objectivity, and reputation). Contextual DIQ is associated with the fitness of the data and information to support the task being undertaken (i.e., value added, relevancy, timeliness, completeness, appropriate amount of data). Representational DIQ indicates that the information is easy to understand and to process by data consumers (i.e., interpretability, ease of understanding, representational consistency, and concise representation), and accessibility DIQ refers the information systems’ support of data and information security and accessibility (Wang & Strong, 1996; Lee et al., 2002).

In relation to XBRL based financial reporting and decision making, the author is particularly interested in two of the DIQ categories, namely, contextual DIQ and representational DIQ. These categories have an important association with the subjective aspects of financial statements’ DIQ (Dourish et al., 1993; Ballou & Pazer, 2003). While these two DIQ categories play a pivotal role in users’ performance and decision making, there appears to be very limited research examining how these DIQ dimensions are perceived by XBRL-based financial statement users, or how better DIQ may lead to better decision making (Wang & Strong, 1996). Therefore, examining whether the presentation of XBRL-based financial statements conforms to those DIQ attributes and whether such presentation influences decision factors and subsequently improves decision making is worthy of investigation.
2.2 Nonprofessional Investors and Investment Decision Making

Prior researchers note that nonprofessional investors possess particular characteristics, e.g., a lack of investment experience and have little background knowledge of their investments (Pinsker, 2007), their investments assume low priorities compared to professional investors (Pinsker & Wheeler, 2009), and their decision making style often relies on unsophisticated frameworks (Hodge & Pronk, 2006). Despite their characteristics, nonprofessional investors still wield considerable influence on companies (NYSE, 2002; Pitre et al., 2009; Koonce, Williamson & Winchel, 2010). Capital market authorities also seek to attract more nonprofessional investors (Jurney, 2008).

Prior studies related to nonprofessional investors have mainly examined how financial information influences nonprofessional investors’ decision making. Findings from these studies suggested that the appropriate financial information provided to nonprofessional investors promotes better informed investment decisions (Jurney, 2008). Such information needs to conform to nonprofessional investors’ cognitive abilities and requirements to solve their investment tasks. For example, Scarlata, (2009) reported that XBRL-based financial statements helped improve nonprofessional investors practical and tactical behaviour resulting in better investment decision making. Arnold, et al. (2012), found that nonprofessional investors more easily captured relevant information using XBRL-based financial statements.

2.3 Research Model and Hypothesis Development

This research seeks to examine the link between XBRL, DIQ, decision factors and investment performance outcomes. The research model presented in Figure 1 illustrates this aim.

![Figure 1. Research Model](image)

Data and information quality shown in Figure 1 refers to users’ contextual and representational DIQ perceptions. Contextual DIQ (i.e., appropriate amount of data and relevancy), and representational DIQ (i.e., ease of understanding, and representational concision) are relevant to the user's perceptions of financial information content. Perceptions and expectations of DIQ are often different for each user (Dourish et al., 1993, Watts, Shankaranarayanan & Even, 2009). Contextual DIQ is enhanced by providing the relevant information in an easily retrievable format, which also helps enhance the information’s value. Representational DIQ is enhanced by information that is easy to process and interpret, thus, further helping to support decision making (Lee et al., 2002). Different users have different needs and abilities to process information and, hence, investigating how XBRL-based financial statements with higher levels of contextual and representational DIQ are perceived by
nonprofessional investors is central to differentiating XBRL-based financial statements from non XBRL-based financial statements.\(^1\)

**Hypothesis 1:** XBRL financial statements are perceived by users to be better DIQ than non XBRL financial statements.

XBRL-based interactive financial statements having higher contextual and representational DIQ are posited to deliver better information to financial statement users. Prior research has examined how contextual DIQ affects information acquisition. For example, Wu, Chuang & Joung, (2008) suggested contextual DIQ simplifies information searching and increases users’ confidence in making investment decisions. Jung (2005) found that time spent problem solving by users was substantially reduced by the presence of contextual DIQ. While contextual DIQ focuses on nonprofessional investors’ information retrieval, representational DIQ aligns more closely with their cognitive abilities. Prior studies in accounting information processing relative to individual cognition (see, e.g., Kelton, Pennington & Tuttle, 2010; Kelton & Pennington, 2012; Dilla, Janvrin & Jeffrey, forthcoming) established that financial information with representational DIQ aligning with users’ mental representations, lead to improvements in decision making performance. In the following hypotheses, the author will use the term “XBRL-based interactive financial statement” to refer XBRL-based financial statements with both contextual DIQ and representational DIQ.

**Hypothesis 2:** Subjects who are provided with XBRL-based interactive financial statements will make better informed investment decisions than subjects who are provided with non XBRL-based financial statements.

**Hypothesis 2a:** Subjects who are provided with XBRL-based interactive financial statements will, or perform investment tasks more accurately than subjects who are provided with non XBRL-based financial statements.

**Hypothesis 2b:** Subjects who are provided with XBRL-based interactive financial statements will spend less time to perform investment tasks than subjects who are provided with non XBRL-based financial statements.

**Hypothesis 2c:** Subjects who are provided with XBRL-based interactive financial statements are more willing to invest in the provided investment scenario than subjects who are provided with non XBRL-based financial statements.

XBRL’s ability to enable quick information retrieval, enhance transparency, and to reduce information asymmetry, align with the dimensions of transaction cost analysis (TCA). Uncertainty and bounded rationality are the two essential dimensions in TCA (Cordella, 2006). Nonprofessional investors need to consider these two dimensions when acquiring information and making decision, particularly in relation to transaction costs. Search costs, defined as ‘the cost of locating information on the opportunities for exchange’(Cordella, 2006, p.196), are considered appropriate to conceive as transaction costs. Thus, the TCA framework is appropriate for this study as XBRL can help lower information search costs (Peng, Shon & Tan, 2011), reduce uncertainty (see, e.g., Roohani et al., 2009; Bonson et al., 2010; Yoon et al., 2010; Kim et al., 2012), and help increase time devoted to analysing financial statements by reducing time consumed in error-prone re-inputing activities (see, e.g., Pinsker, Gara & Karim, 2005; Farewell, 2006; Bartley, Chen & Taylor, 2011).

**Hypothesis 3:** Subjects who are provided with XBRL-based interactive financial statements exhibit lower uncertainty, thereby resulting in better investment performance outcomes than subjects who are provided with non XBRL-based financial statements.

Heuristic processing is likely to occur in decision making activity (Tversky & Kahneman, 1974). Heuristic information processing appears to be used by both professional and nonprofessional investors. Substantial quantities of financial information compel professional and nonprofessional investors to perform heuristic information processing. Professional investors appear to undertake their

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\(^1\) For example, PDF-based financial statements.
information heuristic processing via practical and tactical action, while nonprofessional investors appear to simplify and limit their information acquisition, thus making decisions with little cognitive effort (Kleinmuntz & Schkade, 1993; Monti, Boero, Berg, Gigerenzer & Martignonon, 2012). Thus, professional investors’ heuristic information processing appears better developed than that of nonprofessional investors. Professional investors heuristic processing is characterized by their skill to combine prior knowledge, investment tasks and financial information clues, and to search information directly, thus accelerating their investment decision making (Hunton & McEwen, 1997; Scarlata, 2009). Scarlata (2009), found XBRL to be capable of mitigating the limitations of nonprofessional investors’ information processing. The author argues that XBRL-based interactive financial statements will help nonprofessional investors undertake financial analyses more like professional investors and, therefore, make better informed investment decisions.

**Hypothesis 4:** Subjects who are provided with XBRL-based interactive financial statements will undertake better heuristic information processing leading to better investment performance outcomes than subjects who are provided with non XBRL-based financial statements.

Drawing on TTF theory, tasks, technology and individuals are the three key elements in TTF theory (Goodhue & Thompson, 1995). Tasks are the actions performed by individuals to change inputs to outputs. In this study, investment tasks refer to the set of necessary activities undertaken when investment decision making. Technologies are the tools individuals use to aid their problem solving tasks. In this context, technologies are related to the use of XBRL-based interactive financial statements which individuals use to support their problem solving tasks. Prior knowledge and motivation to use technology affects individuals’ performance when they interact with technologies. Individuals in this research are nonprofessional investors (Goodhue & Thompson, 1995; D’Ambra, Wilson & Akter, 2013). Those using XBRL-based financial statements have a better alignment between their tasks, the technology used and the characteristics and as such will arrive at better informed decisions.

**Hypothesis 5:** Subjects who are provided with XBRL-based interactive financial statements will confirm the TTF is indicated by the better investment performance outcomes than subjects who are provided with non XBRL-based financial statements.

**Hypothesis 5a:** XBRL-based interactive financial statements better align with task characteristics, resulting in better investment performance outcomes by nonprofessional investors.

**Hypothesis 5b:** XBRL-based interactive financial statements better align with technology characteristics, resulting in better investment performance outcomes by nonprofessional investors.

**Hypothesis 5c:** XBRL-based interactive financial statements better align with individual characteristics, resulting in better investment performance outcomes by nonprofessional investors.

3 RESEARCH METHOD

3.1 Research Design

Experiments will be conducted to test the proposed hypotheses. Quantitative data will be collected via laboratory experiments in which contextual and representational DIQ are manipulated. The research will use real financial data for both the XBRL-based financial statements and non XBRL-based financial statements to achieve better external validity. XBRL-based financial statements will be obtained from the SEC and accessed via www.calcbench.com², while the non-XBRL-based financial statements will be PDF versions of companies’ financial statements. The author posits that these

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² Calcbench.com provides interactive XBRL-based financial statements including an interface allowing users to directly retrieve financial information and apply that information to their tasks, compare different financial statements in an appropriate format, and view graphical representations of the information.
features align with DIQ dimensions of appropriate amount of data, relevancy, ease of understanding, and representational concision. These embedded features represent the DIQ dimensions. DIQ dimensions of ‘appropriate amount of data’ and ‘relevancy’ correspond with contextual DIQ, while ‘ease of understanding’ and ‘representational concision’ are associated with representational DIQ.

Participants in this experiment will be randomly assigned to two groups. The XBRL-based material will be given to the treatment group, with the control group receiving PDF-based versions of the financial statements. Perceived DIQ and decision factors such as uncertainty, heuristic processing, task characteristics, technology characteristics, and individual characteristics, will be assessed via questionnaires. Investment decisions will be assessed by the measured accuracy of the investment decision tasks, the time taken to arrive at a decision, and the willingness of the participants to invest.

3.2 Participants

Dennis & Valacich (2001) suggest the participants in experimental research should align with the supporting theory and should have characteristics appropriate to the research. As this research does not involve ethical decision making and professional judgement, postgraduate business students will be appropriate participants in this study. The use of business students in experimental research related to general cognitive abilities and financial analysis are generally considered appropriate for such tasks (see, e.g., Libby, Bloomfield, & Nelson, 2002; Elliott et al., 2007; Liyanarachchi, 2007). Furthermore, Elliott et al. (2007) note that business students are good analogues for nonprofessional investors. Given that this research will employ multivariate statistical analysis, a large sample size will be required to adequately test the proposed hypotheses. Approximately 20 doctoral students will be invited to participate in the pilot test and 200 postgraduate business students will be invited to the main experiment.

4 FUTURE WORK

4.1 Experimental Design

This research will employ a web-based experiment. A dedicated URL and host will be used to operationalise the experimental material. Prior to the experiments, participants will receive an online research information sheet and consent form. Upon consent to participate, participants will complete a short demographic questionnaire. Next, the experimental material containing the XBRL-based or PDF-based financial statements will be randomly assigned to the participants. Subsequently, participants will receive investment tasks requiring them to analyse financial statements, e.g., calculating current ratio, ROA, operating profit margin, and PE ratios (see, e.g., Hodge et al., 2004; Cong, Du & Feng, 2008; Scarlata, 2009). Participants will next be asked to allocate an amount of imaginary funds based on the investment fund interval provided in the experimental material (see, e.g., Bailey & Sawers 2012; Dilla et al., forthcoming). After concluding their investment tasks, participants will be asked to fill in questionnaires that will collect participants’ perceptual data. These measures will be adapted from prior research, e.g., perceived DIQ (Lee et al., 2002); uncertainty (Devaraj, Fan & Kohli, 2002); heuristic processing (Watts et al., 2009), task characteristics, technology characteristics, and individual characteristics (Goodhue & Thompson, 1995). Figure 2 below illustrates the experimental design.
4.2 Data Analysis

Two types of data will be collected in this research; quantitative data and perceptual data. The two data types will be analysed separately using applicable statistical techniques to make appropriate inferences. Independent variables (i.e., XBRL-based financial statements and non XBRL-based financial statements) and dependent variables (i.e., decision time and investment task accuracy) will produce quantitative data, while other variables (i.e., perceived DIQ, uncertainty, heuristic processing, task characteristics, technology characteristics and individual characteristics) will produce perceptual data. Analysis of variance will be used to test Hypothesis 1, while multivariate analysis of variance (MANOVA) will be used to test Hypotheses 2, 2a, 2b, 2c. Hypotheses 3, 4 and 5, 5a, 5b, and 5c will be tested using multiple comparisons for path analysis.

5 CONCLUSION

In this paper the author discussed the link between financial statement format, data information quality (DIQ), decision factors, and investment outcome performance. This research is required to explore users’ interactions with XBRL-based financial information to confirm whether XBRL, via improved DIQ, helps users to arrive at better informed investment decision.
References


