

**QUALITY MANAGEMENT IN ACCOUNTING FIRMS:  
AN ERROR MANAGEMENT APPROACH**

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**ON AUDIT QUALITY AND ERROR MANAGEMENT:  
TOWARDS A SOCIO-COGNITIVE MODEL**

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## SYNOPSIS

### Introduction

Audit quality is crucial in today's market economies because it 'underpin[s] the integrity of financial markets, [and thus] enable[s] complex international transactions' (Greenwood, Morris, Fairclough, & Boussebaa, 2010: 173). The importance of audit quality is particularly apparent in cases in which accounting firms fail to provide the requisite audit quality. Such failures have resulted in accounting scandals, such as those at Enron (2001), Worldcom (2002) and - more recently - Lehman Brothers (2008). As a response to such accounting scandals, regulators and practitioners are continuously trying to improve audit quality through various initiatives. Current prominent initiatives include the guidelines suggested in the Green Paper by the European Commission (European Commission, 2010) and the audit quality framework suggested by the International Auditing and Assurance Standards Board (IAASB; International Auditing and Assurance Standards Board, 2013). Similarly, audit quality is also an extensively researched topic in academia. Recent work has examined multiple influences such as legal regulations (Francis & Wang, 2008; Venkataraman, Weber, & Willenborg, 2008), professional self-regulation (Grant & Bricker, 1996), audit firm size (DeAngelo, 1981a; Francis & Yu, 2009), nonaudit services (Firth, 1997; Francis, 2006), low balling (DeAngelo, 1981b; Lee & Gu, 1998), tenure (Carey & Simnett, 2006; Deis & Giroux, 1992; Myers, Myers, & Omer, 2003), client corporate governance (Karamanou & Vafeas, 2005; Lennox & Pittman, 2010) and industry specialization (Dunn & Mayhew, 2004; Owghoso, Messier, & Lynch, 2002).

However, despite the relevance of audit quality for regulators and practitioners and the interest in audit quality in academia, Francis (2011) recently posed the question, 'given the potential relevance and importance of audit quality research, why does it seem to have so little impact on practice and regulation?' (Francis, 2011: 144). In discussing the relevance of audit quality research, Francis (2011) identifies two major issues for future research to address. First, he emphasizes that audit quality researchers have difficulties to communicate the wealth of their findings in a comprehensive manner; therefore, he calls for a literature review of the antecedents of audit quality. Second, he laments that, 'research on the relation between accounting firms and audit quality is severely limited by the availability of data on characteristics of accounting firms. To date, research on this topic has relied on variables that

can be constructed from public disclosures such as client-based measures of industry expertise and office size. However, these measures do not go inside the ‘black box’ of the accounting firm’s organizational structure and operations’ (Francis, 2011: 138). He concludes his discussion by suggesting that ‘further progress will be best achieved through collaborative research among scholars, firms, and regulators, and this collaboration would ideally include private data from accounting firms and regulators that are required to move beyond our current knowledge and to more fully understand and ultimately to improve audit quality’ (Francis, 2011: 145).

In my dissertation, I respond to Francis’s (2011) calls. Based on a literature review on the antecedents of audit quality, I use a new approach to open up the ‘black box’ of the accounting firm’s organizational structure and operations’ (Francis, 2011: 138) by transferring insights from the field of error management. Error management has been highlighted as a crucial aspect in understanding quality in research from various fields, such as research on high reliability organizations (Bigley & Roberts, 2001; Roberts, 1990; Weick, Sutcliffe, & Obstfeld, 2008), error management (Keith & Frese, 2008; Rybowskiak, Garst, Frese, & Batinic, 1999; Van Dyck, Frese, Baer, & Sonnentag, 2005), normal accidents (Perrow, 1984, 1994), safety culture (Hofmann & Morgeson, 1999; Morgeson, Nahrgang, & Hofmann, 2011), organizational errors (Edmondson, 1996, 1999; Edmondson, Bohmer, & Pisano, 2001) and total quality management (Douglas & Judge Jr., 2001; Hackman & Wageman, 1995). Despite the differences in approaches, views, and definitional nuances in such research, the consensus is that understanding error management is a key to understanding the production of quality. However, besides initial attempts to study error management in accounting firms (Gold, Gronewold, & Salterio, in press) our understanding of this crucial aspect remains scarce. The three articles of this dissertation attempt to address this gap in the literature.

### **Paths Through this Work**

In the first article of my dissertation, ‘*Antecedents of Audit Quality: Taking Stock and Moving Forward*’, I systematically review the literature on the antecedents of audit quality. In this article, I summarize the empirical and theoretical research findings in a three-level model consisting of macro, meso and micro levels. On the macro level, I review the findings on the antecedents of audit quality in the institutional environment, which includes the legal environment and professional self-regulation. On the meso level, I present the findings on the inter-organizational level and summarize previous research on client corporate governance, tenure, low balling, nonaudit services, audit hours, audit firm size and industry specialization.

On the micro level, I summarize the research findings at the within-firm level, which includes research on firms' audit approach, management controls and auditor characteristics. The literature review shows that we have made considerable progress in understanding audit quality but also reveals three main shortcomings of research in this field. First, the article highlights that our understanding of audit quality on the micro level - within accounting firms - remains limited. Therefore, I suggest that we transfer insights from research in different fields that have generally stressed the importance of understanding the functioning within organizations in order to understand the production of quality. Second, the literature review underscores that research into audit quality is limited by a lack of diversity in research designs and data sets. Thus, I suggest that future research further the understanding of audit quality by using more diverse research designs and data sets. Third, the review highlights that previous research on audit quality has mainly focused on auditors' independence; however, our understanding of the role of auditors' competence remains limited. Therefore, I suggest that future research may transfer insights from research in other fields that have stressed the importance of competence in understanding quality.

In the second paper of my dissertation, *'Leveraging Error to Improve Audit Quality: Towards a Socio-Cognitive Model'*, my co-author (Markus Reihlen) and I attempt to address the research gaps that we have identified in the literature. In this article, we investigate audit quality on the micro level by using a case study approach that focuses on auditors' competence. In particular, this research draws on insights from the error management literature and uses an embedded case study design to explore error management in accounting firms. Based on 18 months of participant observations, 38 interviews, and archival materials from a Big 4 accounting firm, we propose a socio-cognitive model that explains error management as a self-reinforcing system, in which structures, systems, organizational practices and individual skills interact and jointly constitute and reconstitute one another in the production of audit quality. In particular, our study shows how organizational error prevention practices shape resilient individuals, who are important in developing resilient error management practices in audit teams. Furthermore, resilient error management practices are reflected in the organizational structures and systems supporting error management in accounting firms. Our socio-cognitive model contributes to the literature by pushing research toward an integrated approach to error management rather than toward either an error prevention or error resilience approach. Moreover, the socio-cognitive model of error management is the first comprehensive model to explain varying degrees of audit quality on



the micro level. Therefore, the socio-cognitive model provides a more complete understanding of the production of audit quality in practice.

In the third paper, '*Leveraging Error to Improve Performance: A Model of Individual Error Management*', my co-author (Sebastian Fischer) and I examine a crucial component of the socio-cognitive model of error management: the individual. In this article, we investigate individual differences in error management and their implications for learning and performance in a two-phase mixed methods study. In the first phase, we use an inductive approach to explore individual error management in an in-depth field study involving 12 months of participant observation and 38 interviews. Our research findings inform a model of individual error management in which humility and self-efficacy are antecedents of error management and in which there are positive associations among error management, learning and performance. In the second phase, we test the resulting propositions in a questionnaire study ( $N = 278$ ). The findings of our structural equation modeling confirm the suggested relationships. The findings of this research contribute to the literature by highlighting the importance of understanding individual error management to understand human errors in the context of organizations more comprehensively. Furthermore, these findings have important implications for practice by demonstrating the role of individual error management in learning and performance.

### **Concluding Remarks**

Taken together, these three articles build upon one another. In the first paper, I lay the groundwork for my dissertation by systematically reviewing the literature on the antecedents of audit quality. During this review, I acknowledge the progress made by previous research on the antecedents of audit quality, and I also identify the three main shortcomings of such research. In the second paper, my co-author and I address some of these shortcomings by employing a new approach to understanding audit quality. This approach entails examining audit quality on the micro level by transferring insights from the field of error management. The resulting socio-cognitive model of error management highlights the important role of the individual in integrating the error prevention approach with the error resilience approach to error management. In the third paper, my co-author and I attempt to refine our understanding of the socio-cognitive model by investigating the individual's role in error management. In this study, we try to understand individual differences in error management and their impact on learning and performance.

In conclusion, this dissertation contributes to the scholarly discourse on audit quality and error management. Based on gaps in the literature on audit quality and insights from the error management literature, we suggest a socio-cognitive model of error management that informs both the field of error management and the field of audit quality. On the one hand, the socio-cognitive model offers a new theoretical framework that pushes the general research agenda on error management from either an error prevention approach or an error resilience approach towards an integrated view on error management. On the other hand, the socio-cognitive model of error management provides the first comprehensive micro-level model of audit quality. By elucidating the role of the individual in the socio-cognitive model, we have merely taken one step toward refining our understanding of the components within the socio-cognitive model. Hopefully, future research will also find the socio-cognitive model helpful and examine further aspects because I believe that the socio-cognitive model may be one step to improve our understanding of error management and ‘to more fully understand and ultimately to improve audit quality’ (Francis, 2011: 145).

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**ANTECEDENTS OF AUDIT QUALITY:  
TAKING STOCK AND MOVING FORWARD**

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### **ABSTRACT**

Despite extensive research on audit quality, a systematic investigation of the antecedents of audit quality is missing from the literature. In this article, I review the research on the antecedents of audit quality and present the findings on three levels. On the macro level, I review the findings on the antecedents of audit quality in the institutional environmental, which includes the legal environment and professional self-regulation. On the meso level, I present the findings on the inter-organizational level, which includes client corporate governance, tenure, low balling, nonaudit services, audit hours, audit firm size, and industry specialization. On the micro level, I present the findings on the audit firm-level, which includes firms' audit approach, management controls, and auditor characteristics. Despite highlighting the merits of previous research, this review also reveals three major challenges for research on audit quality. First, research on audit quality has neglected the micro level in investigating audit quality. Second, research on audit quality lacks a diversity of research designs and data sets to obtain a more comprehensive understanding of audit quality. Third, research on audit quality has neglected the relevance of auditor competence in understanding audit quality. Based on these three challenges, I provide suggestions for future research by transferring insights from research related to quality in other fields.

**Key words:** Audit Quality, Literature Review

## INTRODUCTION

Currently, the European Commission (European Commission, 2010) and the International Auditing and Assurance Standards Board (IAASB; International Auditing and Assurance Standards Board, 2013) are working on initiatives to improve audit quality. The European Commission has released a green paper aiming to improve audit quality (Humphrey, Kausar, Loft, & Woods, 2011), which notes that ‘the Commission is keen to assume leadership at the international level on this debate and will seek close co-operation from its global partners within the Financial Stability Board and the G20’ (European Commission, 2010: 3). Furthermore, the IAASB has released a consultation paper aiming to improve audit quality and ‘raise awareness of key elements of audit quality’ (International Auditing and Assurance Standards Board, 2013: 9). Considering these initiatives to improve audit quality, Francis (2011) recently posed the question, ‘given the potential relevance and importance of audit-quality research, why does it seem to have so little impact on practice and regulation?’ (Francis, 2011: 144). In answering his question, he highlights that one reason is that research on audit quality has faced difficulties in communicating the wealth of findings in a comprehensive manner. Therefore, Francis (2011) calls for a literature review on the antecedents of audit quality.

I respond to Francis’ (2011) call by reviewing the literature on the antecedents of audit quality. In providing a systematic review of the literature on the antecedents of audit quality, the contribution of this article is threefold. First, this article provides a comprehensive review of what we know about the antecedents of audit quality. By comprehensively summarizing the empirical and theoretical findings on audit quality in the literature, this article provides a basis for communicating the findings of such research to practitioners and regulators. Second, this article outlines three major shortcomings of previous research on the antecedents of audit quality: a lack of research on the micro level, a lack of research diversity, and a lack of research on auditors’ competence. By pointing out these three shortcomings, I provide directions for future research on audit quality. Third, considering these shortcomings, I present findings from research related to quality from other fields and outline research questions that may provide future research opportunities.

The remainder of this paper proceeds as follows: In section 2, I describe the method used to identify relevant literature on the antecedents of audit quality. In section 3, I review the literature on three levels of analysis. In section 4, I discuss the major shortcomings of this



stream of literature. Based on these shortcomings, I provide suggestions that may stimulate future research.

### **IDENTIFICATION OF RELEVANT LITERATURE**

This review is based on research on the antecedents of audit quality in publications from ten of the major journals in the field of accounting. I chose to limit the literature review to articles from ten of the major journals in the field of accounting for three reasons. First, these ten journals have the highest impact in the field of accounting and are thus considered to be the most prestigious journals in the field (Bonner, Hesford, Van der Stede, & Young, 2006). Second, the communicated findings within these journals can be considered to be validated knowledge (Hutzschenreuter & Kleindienst, 2006). Third, I argue that the major contributions in the field of audit quality have been discussed in these journals. To identify the major journals in the field of accounting, I started by reviewing the Journal Quality List (43<sup>th</sup> edition) (Harzing, 2012). The advantage of using the Journal Quality List is that it combines journal rankings from around the world, allowing relevant journals to be identified from different regional contexts (Harzing, 2012). Using the Journal Quality List, I identified the relevant journals based on their impact factor and the number of articles published on the antecedents of audit quality. On the basis of this analysis, I identified the following ten journals as the major outlets for discussing the antecedents of audit quality:

**TABLE 1:**  
**Selected Journals for the Literature Review**

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<b>Name of Journal</b>
Accounting, Organizations and Society
Auditing: A Journal of Practice & Theory
Contemporary Accounting Research
European Accounting Review
International Journal of Accounting
Journal of Accounting, Auditing and Finance
Journal of Accounting and Economics
Journal of Accounting and Public Policy
Journal of Accounting Research
The Accounting Review

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To identify the relevant articles, I conducted a three-stage search. First, I conducted a computerized search of the literature using the ISI Web of Knowledge. The key words that I used were audit quality, auditor competence and auditor independence. The key words derive from a widely used definition of audit quality from DeAngelo (1981a), who defines audit quality as the ‘joint probability that a given auditor will *both* (a) discover a breach in the client’s accounting system, and (b) report the breach’ (DeAngelo, 1981a: 186). While the first aspect of this definition focuses on the competence of the auditor, the second aspect is concerned with auditors' independence (Arrunada, 2000). In a second step, I reviewed the reference lists of the selected articles to conduct a backward search of articles that are cited on the topic. In a third step, I reviewed the publication lists of prominent scholars in the field to identify relevant papers on the subject. The time frame for my search was January 1981 to May 2012. The year 1981 was selected as the starting point because both articles from DeAngelo are from 1981 (1981b, 1981a), presenting a seminal date in the history of research on audit quality. This procedure yielded in 201 articles.

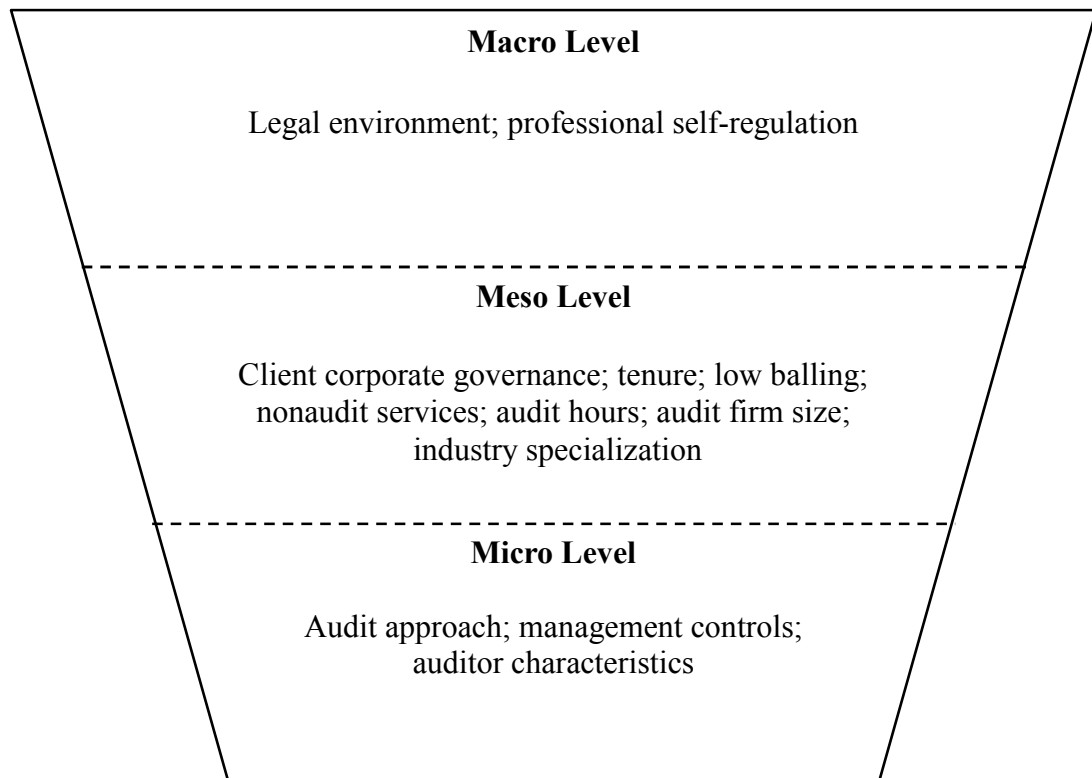
To identify articles on the antecedents of audit quality, I reviewed the abstracts of the articles and excluded articles that are not within the scope this paper, including studies that explore the demand side of audit quality (Clarkson & Simunic, 1994; Datar, Feltham, & Hughes, 1991; Titman & Trueman, 1986), the perception of audit quality (Ghosh & Moon, 2005; McKinley, Pany, & Reckers, 1985; Warming-Rasmussen & Jensen, 1998) and the consequences of different levels of audit quality, such as market reactions (e.g. Mitton, 2002; Nichols & Smith, 1983), audit client costs (Firth & Smith, 1992; Khurana & Raman, 2004; Mansi, Maxwell, & Miller, 2004; Pittman & Fortin, 2004), audit fees (Hay, Knechel, & Wong, 2006; Ireland & Lennox, 2002) and litigation risks (Kadous, 2000; Palmrose, 1997). This review resulted in a working list of 83 articles directly related to the antecedents of audit quality.

## **REVIEW OF THE LITERATURE**

I agree with Ginsberg and Venkatraman (1985) and Hutzschenreuter and Kleindienst (2006) that an analytical framework is useful for systematically summarizing the contributions within a field, mainly because an analytical framework allows for the systematic communication and identification of gaps in the literature (Ginsberg & Venkatraman, 1985; Hutzschenreuter & Kleindienst, 2006). A review of previous research suggests that the

antecedents of audit quality can be analyzed on three levels: the macro level, the meso level and the micro level (see Figure 1).

**FIGURE 1:**  
**A Three-Level Model of the Antecedents of Audit Quality**



**Macro level.** Research on the macro level focuses on the influence of the institutional environment on audit quality. This level of analysis includes the influence of antecedents of the legal environment, such as different liability rules, investor protection regimes and auditor protection regulations, on audit quality. Moreover, research on the macro level has examined the role of the professional self-regulation on the provision of audit quality.

**Meso level.** Research on the meso level focuses on the influences of inter-organizational factors between audit firms and their clients. This level of analysis includes research on client corporate governance, audit firm and audit partner tenure, low balling, nonaudit services, audit hours, audit firm size and industry specialization.

**Micro level.** Research on the micro level focuses on functioning within audit firms, including research on audit approach, management controls and auditor characteristics.

## **Macro Level**

**Legal environment.** There is strong evidence that a clear and strict legal environment is positively associated with audit quality. Empirical evidence on the influence of the legal environment on audit quality is provided from studies from all around the world. For example, Francis and Wang (2008) examine the influence of a country's investor protection regime on audit quality in 42 countries. In their study, they find that audit quality is higher in countries with stronger investor protection regimes. Maijor and Vanstaelen (2006) report similar findings from a study of different European countries. In particular, they find that legal environments with stricter auditor independence rules and legal liability are related to higher audit quality. Similarly, Favere-Marchesi (2000) finds that differences in audit quality among ASEAN countries are due to differences in the legal environments among these countries. In addition, studies examining the effects of regime switches for audit quality in the US (Venkataraman, Weber, & Willenborg, 2008) and China (DeFond, Wong, & Li, 1999) provide evidence for the effect of the legal environment on audit quality. Apart from these empirical studies, formal models describe this relationship. For example, Schwartz (1997) shows that only strong legal environments can induce a socially optimal level of audit quality. Similarly, DeJong (1985) argues that a more litigious legal environment results in higher audit quality in the long run.

Several reasons for the influence of the legal environment and audit quality, including auditors' desire to protect their reputations, the cost of litigation, and the effect of auditor protection through audit committees, are provided in the literature. DeAngelo (1981a) argues that in stricter legal environments, auditors have a stronger incentive to report audit findings that protect their reputation. Moreover, Dye (1993) argues that stricter legal environments are associated with higher litigation costs and thus provide direct economic incentives to provide higher audit quality. Furthermore, Willekens, Steele and Miltz (1996) demonstrate that only with clear legal standards do auditors offer an optimal level of effort, showing that unclear legal standards lead to underauditing or overauditing as a result of uncertainty. However, a clear and strict legal environment seems to have a stronger effect for Big audit firms in comparison to non-Big audit firms. DeAngelo (1981a) argues that Big audit firms have more to lose in terms of reputation and will thus provide higher audit quality. Similarly, Dye (1993) argues that Big audit firms have higher wealth at risk in litigation cases and thus have stronger incentive to provide higher audit quality. Empirical evidence for the stronger effect for Big audit firms stems from Francis and Wang (2008), who find an effect of investor protection regimes on audit quality only for Big firms.

The type of legal liability regime has an important influence on audit quality. For example, Acemoglu and Gietzmann (1997) show in a formal model that if legal liability is either too high or too low, the audit market will collapse: on one hand, if legal liability is too high, auditors will insure against such risk, making audits too expensive; on the other, if legal liability is too low, stakeholders will not believe in the independence of auditors, thus diminishing the value of the audit reports. Further studies on legal liability have compared different liability regimes. Narayanan (1994) discusses the effects of two liability regimes (joint and several liability and proportionate liability) and provides evidence that a proportionate liability regime has a positive effect on audit quality since litigation costs are more sensitive to auditors' effort. Hillegeist (1999) expands the discussion by stressing the effect of different liability regimes on firm owner reporting strategies. He finds that a proportionate liability regime will decrease not only the audit failure rate but also the audit quality, given the strategic interaction between the owner and the auditor. Furthermore, Lee and Mande (2003) investigate a regime switch to examine the effect of a joint and several liability regime on audit quality and find that audit quality is higher for joint and several legal liability regimes.

Finally, Van Tedeloo and Vanstraelen (2008) note that enforcement through institutions is an important factor for understanding audit quality. They investigate audit quality in the European context and find that audit quality is higher in countries where tax authorities also scrutinize financial statements. Similarly, King and Schwartz (1999) find that legal penalties influence auditors' efforts in providing higher quality audits. Concerning the enforcement of standards, Zhang (2007) suggests that 'if the legal system alone fails to maintain high audit quality, a regulatory monitoring system will help to improve audit quality' (Zhang, 2007: 642). Zhang suggest that such a legal monitoring system may be implemented by either the regulator or the audit profession.

***Professional self-regulation.*** Research suggests that professional self-regulation plays an important role in maintaining audit quality. For example, Grant and Bricker (1996) suggest that professional self-regulation increases audit quality. They examine cooperative decisions among actors in a laboratory setting and find that professional organizations effectively increase audit quality, as well as audit consistency. Specifically, professional self-regulation increases cooperation between audit firms in respect to audit quality, which results in higher audit quality in the long run. Furthermore, Nelson Elliott and Tarpley (2002) investigate circumstances in which client managers are more likely to engage in earnings management.

On the basis of their survey, they find that precise standards are positively associated with an increased attempt among auditors to prevent earnings management by management. Their study suggests that audit quality may be increased by clarifying standards within the profession.

Nevertheless, previous research suggests that the effectiveness of professional self-regulation depends on the credibility of the professional organizations within the profession. For example, Grant and Bricker (1996) suggest that professional self-regulation is only effective ‘when there exist effective, quality ensuring mechanisms such as fines and sanctioning powers’ (Grant & Bricker, 1996: 142). A similar argument is put forward by Zhang (2007). Furthermore, an empirical study by Hilary and Lennox (2005) investigate whether the credibility of self-regulation really makes a difference. In their study, they examine the effectiveness of peer reviews initiated by the profession, specifically examining the dismissals and appointments of auditors after the issuance of opinions on the audit quality through peer reviews. They find a clear market reaction and suggest that this market reaction indicates the credibility of these reviews initiated by the profession.

### **Meso Level**

***Client corporate governance.*** Previous research suggests that characteristics of the client corporate governance structure, including the characteristics of the board and the audit committee, are important for understanding audit quality. For example, there is strong empirical evidence for the relation between the presence of an audit committee and the quality of audits. McMullen (1996) finds that the presence of an audit committee is negatively related to ‘shareholder litigation alleging management fraud, quarterly earnings restatements, SEC actions, illegal acts, and auditor turnover involving an accounting disagreement’ (McMullen, 1996: 87). Similar findings are reported by using different proxies of audit quality, such as restatements of prior-year financial statements (DeFond & Jiambalvo, 1991) and quality of earnings (Vafeas, 2005).

Previous research suggests that audit committees improve audit quality by coordinating the work between the client firm and the auditor and by protecting auditors’ independence. McMullen (1996) highlights the coordinating function of audit committees as a reason for the positive relation between audit committees and audit quality. She notes that ‘the findings are consistent with the idea that audit committees, because of their ability to link various groups involved in the financial reporting process, improve the quality of financial statements and disclosures’ (McMullen, 1996: 101). Others authors stress the protective

function of audit committees for auditors. Collier and Gregory (1996) provide evidence that audit committees prevent 'audit fee reductions to levels where the quality of the audit is compromised' (Collier & Gregory, 1996: 177). Similarly, Carcello and Neal (2003) find that audit committees prevent the dismissal of auditors after the issuance of a going-concern report. Additionally, studies that focus on corporate boards support the finding that the protective function of audit committees is an important factor in improving audit quality (O'Sullivan, 2000).

Nevertheless, research suggests that the effectiveness of audit committees and boards depends on their independence, involvement, and expertise. Independence as a moderating variable is stressed by various studies and is robust to the use of various proxies for audit quality, such as earnings management (Klein, 2002) and the probability of issuing going-concern reports (Carcello & Neal, 2000). Also studies of corporate boards stress the importance of independence as a moderating variable (Dechow, Sloan, & Sweeney, 1996; Lennox, 2005; Menon & Williams, 2004; O'Sullivan, 2000). Furthermore, Abbott and Parker (2000) identify the involvement of audit committees as an important aspect in understanding the effectiveness of audit committees. In their study, they find that audit committees with greater involvement tend to choose industry specialists as auditors, resulting in increased audit quality. Furthermore, Knapp (1987) stresses the importance of expertise. He suggests that audit committees with greater expertise are more likely to support auditors in crucial situations, thus increasing auditors' independence.

***Tenure.*** The influence of tenure on audit quality is not yet well understood. Previous research reports mixed results regarding the relationship of tenure and audit quality. On the one hand, some studies, such as Vanstraelen (2000) and Carey and Simnett (2006), report a negative relationship of tenure and audit quality. Vanstraelen (2000) reports that longer audit firm tenure is associated with a lower likelihood of qualified opinions, which she interprets as diminishing audit quality. Furthermore, Carey and Simnett (2006) find a positive relationship between audit partner tenure and 'just beating earnings benchmarks' (Carey & Simnett, 2006: 653) and a lower level of going-concern issues. They suggest that both measures indicate a decrease in audit quality with increasing tenure.

On the other hand, the majority of studies document a positive relationship between tenure and audit quality. Chen, Lin and Lin (2008) examine the influence of audit firm tenure and audit partner tenure on audit quality. Their findings suggest that tenure has a positive impact on audit quality. The findings of Myers, Myers and Omer (2003) provide further

evidence for this relationship. They investigate the effects of audit firm rotation on audit quality and find that audit quality increases with longer audit firm tenure. Moreover, Carcello and Nagy (2004) conclude that audit firm rotation, i.e., shorter tenure, has a negative effect on audit quality. In their study, they find that fraud ‘is more likely to occur in the first three years of the auditor-client relationship’ (Carcello & Nagy, 2004: 55). Thus, they suggest that less tenure is associated with lower audit quality. Similarly, Geiger and Raghunandan (2002) find that audit reporting failures are more frequent in earlier years of auditor tenure. A study from Taiwan also provides evidence that longer audit partner tenure is associated with higher audit quality (Chi, Huang, Liao, & Xie, 2009).

These inconsistent findings may be explained by considering the reasons that tenure is associated with audit quality. Two opposing reasons have been suggested: decreasing independence and increasing competence. Scholars argue that longer tenure is associated with an impeded independence through the development of a personal bond between the auditor and the client (Carey & Simnett, 2006; Vanstraelen, 2000). On the other hand, DeAngelo (DeAngelo, 1981b) suggests that with increasing tenure, auditors’ competence increases. In her study, she argues that auditors become more competent through longer tenure because they are more familiar with the audited firm and associated risks.

Another reason for the inconsistent findings on the relation between tenure and audit quality may be that the time span of tenure moderates the relationship between tenure and audit quality. Longer tenure is associated, on the one hand, with higher competence but, on the other, with decreased independence. Empirical evidence for the moderating effect of time span is provided in a study by Johnson, Khurana and Reynolds (2002), who investigate how different time spans of tenure influence the level of audit quality. In their study, they find that short and medium time spans are associated with lower audit quality, whereas long time spans are not associated with lower audit quality. Their findings suggest that competence overcompensates for the decrease in independence in the long run.

**Low balling.** Low balling is one of the most frequently studied phenomena in research on audit quality. Low balling is defined as ‘setting audit fees below total current costs on initial audit engagements’ (DeAngelo, 1981b: 113). Most of the studies on audit quality assume that low balling impedes auditors’ independence because it creates economic dependency and thus decreases auditors’ independence (Dye, 1991; Simon & Francis, 1988). The strength of low balling has been found to be dependent on the legal environment. For example, Simon and Francis (1988) investigate auditor changes in the US and find an average



initial fee reduction of 24% of normal fee levels. Other studies on low balling in the US (Deis & Giroux, 1996; Ettredge & Greenberg, 1990; Francis & Simon, 1987) and the UK (Gregory & Collier, 1996) support these findings. Yet, low balling has not been found in Australia (Craswell & Francis, 1999; Francis, 1984). However, despite the findings that low balling actually occurs, there is little evidence that low balling impedes independence. Deis and Giroux (1996) examine the influence of low balling on audit quality and find that the existence of low balling is actually associated with higher audit quality. A study by Reynolds and Francis (2000) supports this finding. In their study, they examine the effect of economic dependency on auditors' independence but do not find that auditors compromise their independence due to economic dependency.

Previous research highlights several reasons why low balling may not have a negative effect on audit quality. DeAngelo (1981b) suggest that low balling does not impede auditors' independence because auditors consider the initial investment made through low balling to be a sunk cost, and thus, low balling does not impede auditors' independence in later periods. Similarly, Lee and Gu (1998) show that low balling might even improve auditors' independence. They argue that low balling is a way to strengthen the bond between the auditor and the firm owner. As this bond strengthens, there is less incentive for the auditor to accept side payments by the management, thus improving auditors' independence.

Another reason for the inconclusive findings regarding the effect of low balling on audit quality may be the moderating role of the legal environment. In particular, the clarity of reporting standards and the disclosure of audit fees are found to affect whether low balling decreases audit quality. Concerning the clarity of reporting standards, Magee and Tseng (1990) provide evidence that low balling only threatens independence if financial reporting standards leave more room for interpretation. They argue that this room for interpretation can be used by clients in threats to dismiss auditors if other auditors agree on a different interpretation. However, if all auditors agree on one application of financial reporting standards, clients will not be able to use such threats. Furthermore, the disclosure of audit fees may moderate the relationship between low balling and auditor independence because the client's bargaining power through the initial investment becomes observable by the market participants and the market participants will thus judge auditors' independence accordingly (Dye, 1991). Empirical evidence for this argument is provided by Francis (1984) and Craswell and Francis (1999), who find that the disclosure of audit fees prevents low balling and thus possible independence issues (Craswell & Francis, 1999; Francis, 1984).

**Nonaudit services.** The influence of nonaudit services (NAS) on audit quality has received considerable attention, especially after accounting scandals such as Enron. Yet, previous research presents mixed results for the relationship between NAS and audit quality. On the one hand, studies find a negative relationship between NAS and audit quality, as proxied by auditor-client agreement (Chen, Elder, & Liu, 2005), small earnings surprises (Frankel, Johnson, & Nelson, 2002), discretionary accruals (Frankel et al., 2002), reliance on internal audit evidence (Felix, Gramling, & Maletta, 2005) and accrual quality (Srinidhi & Gul, 2007). On the other hand, studies suggest that NAS do not influence audit quality as proxied by issues of going concerns (DeFond, Raghunandan, & Subramanyam, 2002) and restatements of financial statements (Kinney, Palmrose, & Scholz, 2004). Furthermore, two studies reinvestigate the Enron case and find that there are no indicators that Andersen's independence was compromised through NAS (Ashbaugh, LaFond, & Mayhew, 2003; Chaney & Philipich, 2002). In addition, Reynolds, Deis and Francis (2004), who replicate the study of Frankel, Johnson and Nelson (2002), fail to find a negative effect of NAS on audit quality after controlling for additional measures, such as client growth. Related studies that investigated the fee dependence of auditors on audit quality also fail to find a negative effect of NAS on audit quality (Chung & Kallapur, 2003; Craswell, Stokes, & Laughton, 2002). Moreover, a recent study by Lim and Tan (2008) even suggests that NAS improves audit quality under certain circumstances.

These mixed results of NAS on audit quality may be explained by the opposing effect that NAS have on auditors' independence and auditors' competence. On the one hand, research suggests that auditors might be threatened by the client to agree on a particular accounting issue when the client also buys NAS (Frankel et al., 2002). Furthermore, research suggests that auditors may have a conflict of interest when they audit processes that they previously helped to implement (Felix et al., 2005; Frankel et al., 2002; Simunic, 1984). On the other hand, research indicates that the provision of NAS also increases auditors' competence through knowledge spillovers. In this vein, Beck and Wu (2006) present a model in which auditors may even provide NAS without charging the client if the provision of NAS reduces audit engagement risks through knowledge spillovers.

Research also finds that the relationship between NAS and audit quality is affected by other factors, such as the audit fee–NAS fee ratio, fee disclosure, and industry specialization. Larcker and Richardson (2004) investigate the effect of the ratio of NAS fees and audit fees on audit quality and find that it is not the absolute amount of NAS fees but the ratio of NAS fees and audit fees that affects audit quality. Similar results are presented by Reynolds, Deis

and Francis (2004). Furthermore, Lennox (1999a) suggests that the effect of NAS on audit quality depends on the disclosure of NAS fees. In his study, he investigates the relation between NAS fee disclosure and audit quality and finds that audit quality is not reduced when NAS fees are disclosed. Concerning the knowledge-spillover effect of NAS, Lim and Tan (2008) find that NAS only have a positive effect on audit quality if audits are provided by an industry specialist.

***Audit hours.*** Research suggests that audit quality is positively associated with the amount of audit hours of an engagement. For example, a study by Caramanis and Lennox (2008) provides evidence for this relationship. In a sample of 9,738 audits in Greece, these authors examine the relationship between audit hours and audit quality. They find that ‘when audit hours are lower, (1) abnormal accruals are more often positive than negative, (2) positive abnormal accruals are larger, and (3) companies are more likely to manage earnings upward in order to meet or beat the zero earnings benchmark’ (Caramanis & Lennox, 2008: 116). Based on these findings, they suggest that audit hours are positively associated with audit quality. Similarly, findings are reported for the US context (Deis & Giroux, 1992). Deis and Giroux (1992) even suggest that audit hours can be used as a proxy of audit quality if other measures of audit quality are not available.

***Audit firm size.*** Research suggests that audit firm size is important for understanding audit quality. There is strong empirical evidence from the US that audit firm size has a positive effect on audit quality. Ever since DeAngelo (1981a) argued that audit firm size is important for audit quality, scholars have used a Big vs. non-Big audit firm dichotomy to test the effect of firm size on audit quality. This positive relationship is found using various proxies for audit quality, such as earnings management (Becker, Defond, Jiambalvo, & Subramanyam, 1998; Francis & Krishnan, 1999; Lai, 2009; Vander Bauwhede, Willekens, & Gaeremynck, 2003), audit report accuracy for financial distress (Lennox, 1999b), litigation (Palmrose, 1988), quality control reviews (Deis & Giroux, 1992), reported accounting disagreements (DeFond & Jiambalvo, 1993), auditor reporting conservatism (Francis & Krishnan, 1999), pre-IPO opinion predictiveness regarding post-IPO negative stock delistings (Weber & Willenborg, 2003), GAAS violations (O’Keefe, King, & Gaver, 1994) and management earnings forecast error deviations (Davidson & Neu, 1993). Furthermore, the relationship between audit firm size and audit quality is also found on the office level (Choi, Kim, Kim, & Zang, 2010; Francis & Yu, 2009).

Previous research has mainly discussed four reasons for the positive relationship between audit firm size and audit quality. DeAngelo (1981a) highlights the importance of the reputation of Big audit firms. She argues that the reputation of Big audit firms is at stake to a greater degree than non-Big audit firms and that these firms will therefore provide higher audit quality. Furthermore, Dye (1993) suggests that Big audit firms have deeper pockets in litigation cases. Therefore, he suggests that they have a stronger incentive to produce higher audit quality. Francis and Yu (2009) argue that Big audit firms and Big offices are associated with higher social capital, which enables them to provide higher audit quality. Furthermore, Blokdijk, Driehuisen, Simunic and Stein (2006) provide evidence that Big audit firms have a different audit approach than non-Big audit firms. In their study, they compare the audit approaches of Big firms and non-Big firms and conclude that the difference in the audit approach between Big firms and non-Big firms is the reason that Big firms provide higher audit quality.

However, the relationship between audit firm size and audit quality seems to be sensitive to the type of legal environment. Francis and Wang (2008) examine the relationship between the investor protection regime and audit quality in 42 countries. They find that audit quality of the Big audit firms is higher in countries with stronger investor protection regimes, whereas the quality of non-Big audit firms is not affected by the investor protection regime. They interpret these findings as evidence that Big audit firms are more sensitive to the possible damage to their reputation from low quality audits, explaining why these firms provide higher quality audits. These findings are complemented by studies in the legal environments in Europe and Taiwan. For example, studies in Europe do not find a relationship between audit firm size and audit quality using different measures of audit quality, such as discretionary accruals (Vander Bauwhede et al., 2003) and rounding-up behavior (Van Caneghem, 2004). Furthermore, in testing for an effect of audit firm size on audit quality within a Taiwanese sample, Jeong and Rho (2004) also do not find a significant relationship.

***Industry specialization.*** Industry specialization has been found to be a strong predictor of audit quality. Empirical evidence for this relationship stems from Balsam, Krishnan and Yang (2003). They investigate the relationship between industry specialization and audit quality using two measures (absolute level of discretionary accruals and earnings response coefficients) and find evidence that industry specialization is positively related to audit quality. Studies that use other measures of audit quality, such as the timeliness of reflecting

bad news in earnings (Krishnan, 2005), earnings rounding-up behavior (Van Caneghem, 2004) and the involvement of SEC enforcement actions (Carcello & Nagy, 2004), provide similar findings.

Researchers argue that industry specialists provide higher audit quality for two reasons: they possess specific knowledge and make use of economies of scale. Balsam, Krishnan and Yang (2003) argue that a specialists have greater knowledge of the industry and accounting issues and thus have a greater ability to provide higher quality audits. Empirical evidence for this argument is provided by Solomon, Shields and Whittington (1999). In examining error knowledge of industry specialist auditors, they find that such specialists are better able to identify potential errors and thus provide higher audit quality. Furthermore, Danos and Eichenseher (1982) argue that industry specializations leads to economies of scale. While economies of scale do not directly influence audit quality, this argument is explained by the findings of Elitzur and Falk (1996), who provide evidence that more efficient auditors plan for higher audit quality, thus linking industry specialization with audit quality.

### **Micro Level**

***Audit approach.*** Only few studies investigate the actual audit approach of audit firms to understand differences in audit quality (Blokdijsk et al., 2006). Nevertheless, these few studies suggest that the audit approach of audit firms may have an important influence on audit quality. Blokdijsk, Driehuisen, Simunic and Stein (2006) examine the audit approach of Big and non-Big audit firms in The Netherlands and find that Big audit firms allocate more effort in planning and risk assessment in comparison to non-Big firms. They conclude ‘that the Big 5 firms *actually* produce a higher audit quality level, and that this quality difference is related to how audit hours are deployed in a more contextual and less procedural audit approach’ (Blokdijsk et al., 2006: 27, emphasis in the original). This finding is complemented by Huss and Jacobs (1991), who investigate the client acceptance phase of audit engagement and find that Big audit firms place considerably more importance on client acceptance in comparison to non-Big audit firms. Additionally, Peecher, Schwartz and Solomon (2007) demonstrate how auditors alter their audit approach in order to enhance audit quality in response to changes in the audit environment. They describe how auditors start to put forth more effort to form expectations about plausible developments of client accounts in order to test these expectations against empirical evidence. Furthermore, Elitzur and Falk (1996) provide evidence that a firm’s audit approach may be related to audit quality. In their study, they show how firms with a more efficient audit approach plan for higher audit quality.

Related to efficiency, Williams and Dirsmith (1988) show that a more efficient audit approach is associated with higher audit quality in terms of timeliness of client earnings announcements.

**Management controls.** Previous research suggests that management controls have an important influence on auditors with respect to audit quality (McNair, 1991). Management controls have been defined as a means to exercise power ‘to orchestrate individual and collective action towards [...] given ends’ (Alvesson & Kärreman, 2004: 424). The relationship between management controls and audit quality is highlighted by studies of reduced audit quality behaviors. Reduced audit quality behaviors (RAQ) ‘are defined as actions taken by an auditor during an engagement which reduce evidence-gathering effectiveness inappropriately’ (Malone & Roberts, 1996: 49). Malone and Roberts (1996) examine the influence of audit firms’ quality control system on RAQs. In their study, they find that the perceived strength of the quality control system is negatively associated with RAQs. In this vein, Herrbach (2001) investigates the influence of the socio-ideological control (Alvesson & Kärreman, 2004) of psychological contracts. In his study, he provides evidence that psychological contracts have an important influence on RAQs. Furthermore, Pierce and Sweeney (2004) find that time pressure is positively associated with RAQs (Pierce & Sweeney, 2004). Nevertheless, auditors seem to differentiate between different types of RAQs. For example, Coram and colleagues find that the propensity to commit RAQs depends on the risk associated with the RAQ (Coram, Ng, & Woodliff, 2004) and the perceived moral intensity of the RAQ (Coram, Glavovic, Ng, & Woodliff, 2008).

**Auditor characteristics.** There are some indications that auditor characteristics also influence audit quality. Malone and Roberts (1996) investigate the association between personality characteristics and reduced audit quality behaviors. In their study, they find that need for approval and need for achievement are negatively related to reduced audit quality behaviors. Moreover, Fischbacher and Stefani (2007) show in an experiment that the honesty of auditors plays a crucial role in audit quality. They argue that honest auditors perform more comprehensive audits and thus that ethical standards that foster honesty of auditors improve audit quality.

## DISCUSSION

The main aim of this article is to systematically present the findings in the literature on the antecedents of audit quality. Based on the empirical and theoretical findings of the articles published in 10 of the most prestigious journals in the field, I presented the key antecedents of audit quality and their influence in a three-level model. On the macro level, I presented the influences of the institutional environment, such as the influence of the legal environment and the impact of professional self-regulation. On the meso level, I present the inter-organizational antecedents of audit quality, such as client corporate governance, tenure, low balling, nonaudit services, audit hours, audit firm size, and industry specialization. On the micro level, I presented the findings on the audit firm-level antecedents of audit quality, such as audit approach, management controls, and auditor characteristics. Taking these insights together, I agree with Francis (2011) that there is a wealth of empirical and theoretical research that may provide a good foundation for decisions of practitioners and regulators.

However, this literature review also highlights three main shortcomings of previous literature in our attempt to understand audit quality, which may explain why research on audit quality ‘has so little impact on practice and regulation’ (Francis, 2011: 144). First, the majority of studies on audit quality remain on the macro level and on the meso level; however, studies on the micro level remain scarce. Second, the majority of studies are archival empirical studies or formal theoretical studies, whereas other research designs, such as field studies and experimental studies, are scarcely used. Third, the majority of the research focuses on auditors’ independence; however, auditors’ competence is much less understood. I discuss these three shortcomings in more detail in the following sections and provide suggestions for future research by transferring insights from research related to quality in other fields.

### **Moving the Field Towards the Micro Level**

This literature review highlights that our understanding of audit quality on the micro level is limited. Most studies of audit quality examine the antecedents of audit quality on the macro or meso level. However, our understanding of the audit quality on the micro level remains limited. This lack of research on the micro level was also recently lamented by Francis (2011), who noted that ‘research on the relation between audit firms and audit quality is severely limited by the availability of data on characteristics of audit firms. To date, research on this topic has relied on variables that can be constructed from public disclosures such as client-based measures of industry expertise and office size. However, these measures

do not go inside the ‘black box’ of the audit firm’s organizational structure and operations’ (Francis, 2011: 138).

This relative lack of research the micro level is surprising since research related to quality in most other fields has stressed the importance of micro-level research, including research on high reliability organizations (Roberts, 1990; Weick & Roberts, 1993), error management (Keith & Frese, 2008; Rybowskiak, Garst, Frese, & Batinic, 1999; Van Dyck, Frese, Baer, & Sonnentag, 2005), normal accidents (Perrow, 1984, 1994), safety culture (Hofmann & Morgeson, 1999; Morgeson, Nahrgang, & Hofmann, 2011), and total quality management (Douglas & Judge Jr., 2001; Hackman & Wageman, 1995). Despite the divergent approaches, views, and nuances in definitions in such research, the consensus is that understanding functioning within organizations is key to understanding the production of quality.

Therefore, I suggest that to advance our understanding of audit quality on the micro level, insights from these research areas can be transferred to the accounting context. For example, research on high reliability organizations (HRO) aims to understand organizations that provide highly reliable services even in challenging environments, such as aircraft carriers (Weick & Roberts, 1993), emergency rooms (Edmondson, 1999; Edmondson, Bohmer, & Pisano, 2001; Faraj & Yan, 2006), nuclear power plants (Carroll, 1998) and fire fighters (Weick, 1993). The insights from this research have been summarized by Weick, Sutcliffe, and Obstfeld (2008), who note that the distinctive characteristic of HRO is that they use distinct processes that enable them to provide highly reliable services. Insight on these processes may provide an interesting starting point for future micro-level research on audit quality. For example, future research may investigate the following research questions: Are the processes of high reliability organizations transferable to audit firms? Are these high reliability processes within audit firms related to audit quality? What may lead to the development of high reliability processes in audit firms? Can high reliability processes be described on various levels of analysis within audit firms (e.g., team level, office level, firm level)?

Another example is research on error management. Frese and colleagues (Frese & Hofmann, 2011; Frese & Zapf, 1994; Van Dyck et al., 2005) suggest that it is crucial to understand how organizations manage their errors in order to understand the provision of quality. The underlying assumption of error management is that errors can never be prevented completely; therefore, errors have to be managed in order to reduce the negative consequences of errors (e.g., stress, accidents, bad work environment) and increase the



positive consequences of errors (e.g., learning, innovation, good work environment) (Van Dyck et al., 2005). Initial studies on error management provide evidence that error management is related to positive outcomes on the organizational (Van Dyck et al., 2005) and team level (Edmondson, 1999). For example, van Dyck, Frese, Baer, and Sonnentag (2005) investigate organizational error management culture and find that organizations with high organizational error management culture have high firm performance because, they theorize, such organizations have greater learning, secondary error prevention and work quality. Similarly, Edmondson (1999) examines how teams learn from errors and finds a positive relationship between team learning and team performance. Transferring these insights to the accounting context to gain a better understanding of audit quality on the micro level may be tempting. In particular, the following questions may be interesting to answer: Is organizational error management culture related to audit quality? Do teams differ in their error management, and is their error management related to the quality that they provide? Do audit firm offices differ in their error management, and do differences in error management explain varying degrees of audit quality?

### **Moving the Field Towards More Research Diversity**

A second major shortcoming of research on audit quality is the lack of research diversity with respect to research designs and data sets. Most research on audit quality uses either archival data or formal theory to gain a better understanding of audit quality. However, few studies use surveys, experiments or case studies. This lack of diversity of research methods within the accounting field has also recently been criticized by Chris Chapman (2012). In his article, he suggests: ‘Debates around this topic all too easily reduce to a false dichotomy between diversity and quality, with diversity perceived as a threat to quality. Increased diversity promises to increase the quality of the body of accounting research, however. Accounting is a complex social phenomenon, and so our understanding of it should be enhanced through the adoption of a diverse set of research perspectives and approaches. Grasping accounting in all its complexity is important from an intellectual perspective, but also from the perspective of the ability of our research discipline to contribute back to society’ (Chapman, 2012: 822). I agree with Chris Chapman that a greater diversity of research designs would be helpful, because it would allow understanding the complex phenomenon of audit quality through diverse research perspectives.

In addition, the notion of there being a ‘false dichotomy between diversity and quality’ (Chapman, 2012: 822) seems to be out of date since other fields have long embraced the use

of diverse research methods. For example, McGrath (1981) describes the dilemma of research methods, highlighting the inherent challenge for a single research design to satisfy three crucial criteria of research results: generalizability, precision, and realism. In particular, he notes that some research designs are more concerned with generality (e.g., archival data research, formal models, surveys), whereas others are more concerned with precision (e.g., experiments) or realism (e.g., case studies). Similarly, other authors argue that only a combination of research designs is able to overcome all drawbacks inherent to a single research design (Creswell, 2003; Fine & Elsbach, 2000; Huff, 2009). Therefore, I suggest that we advance research on audit quality by using more diverse research designs. Some interesting ideas in this respect may be to use a case study approach to gain an in-depth understanding of audit quality on the micro level. Survey studies may be used to gain a better understanding of auditor characteristics. Furthermore, mixed methods research may be an interesting approach to combine the strengths of different methods for a variety of topics.

A lack of diversity is also visible in the data sets that we use to understand audit quality. Most research on the macro or meso level examines audit quality in a North American context. Of course, the selection of journals for this review has influenced the data sets that are presented; however, I argue that only by comparing different environments can we further our understanding of the antecedents of audit quality. For example, the phenomenon of low balling is found in a number of countries, such as the US and the UK, whereas low balling is not found in Australia (Craswell & Francis, 1999; Francis, 1984). Furthermore, strong relationships, such as that between audit firm size and audit quality, are found in many studies in the US context; however, such relationships are not found in other legal environments, such as those in Europe (Bauwhede & Willekens, 2004; Van Caneghem, 2004) and Taiwan (Jeong & Rho, 2004). Therefore, I suggest that future research use more diverse data sets to answer the following questions: Why is low balling much more prominent in the US and the UK than in other legal environments? Why is the relationship between audit firm size and audit quality not present in Europe and Taiwan? What are the key antecedents of audit quality on the macro level in emerging markets, such as Russia, Brasil, India and China?

### **Moving the Field Towards a Better Understanding of Auditors' Competence**

A third way to further our understanding of audit quality is by moving towards a better understanding of auditors' competence. Most studies on audit quality on the macro or meso level focus on auditors' independence; however, only very few studies explicitly examine auditors' competence (e.g. Balsam et al., 2003; Krishnan, 2005; Van Caneghem, 2004). As

Humphrey, Moizer and Turley (2006) note: ‘Ironically, despite all the various regulatory developments (whether pre- or post-Enron), attempts over the years to advance and broaden audit methodologies and the apparent growing social and global significance of auditing and governance initiatives [...], we still know only a limited amount about auditing practice, the effectiveness and degree of application of new audit methodologies and the extent to which the audit culture within the large audit firms is conducive to the development and establishment of a public spirited external audit function [...]. It is possible to argue that too much attention is being devoted currently to matters of auditor independence and not enough focus placed on to more basic issues of auditor competence’ (Humphrey et al., 2006: 165).

This relative lack of research on auditors’ competence is surprising considering the importance that research in other fields places on competence, such as research on dynamic capabilities and the knowledge-based theory of the firm. Research on dynamic capabilities has examined how firm competencies are built and reconfigured in order to optimize outputs (Miles, 2012; Teece, Pisano, & Shuen, 1997). In relation to audit quality, this line of research may provide an interesting starting point to address auditors’ competence through the following questions: Are the dynamic capabilities of audit firms associated with audit quality? What are crucial dynamic capabilities in audit firms? What influences dynamic capabilities in audit firms? Similarly, insights from research on the knowledge-based theory of the firm may offer an interesting starting point for research on auditors’ competence. ‘The main idea of the knowledge-based theory of the firm is that organizations exist in the way that they do because of their ability to manage knowledge more efficiently than is possible under other types of organizational structures’ (Miles, 2012: 153). This line of research stresses the importance of understanding knowledge storage and knowledge transfer within organizations (Miles, 2012), and insights from this line of research may be helpful to further understand the quality of services in audit firms, which have been described as knowledge-intensive firms (Alvesson, 2001; von Nordenflycht, 2010). The following research questions may be a starting point to link these two lines of research: Is knowledge management in audit firms related to audit quality? How is knowledge management related to audit quality? Do Big firms and non-Big firms differ in their knowledge management?

## **CONCLUSION**

This article presents a literature review of the antecedents of audit quality. Presenting the key antecedents of audit quality on the macro level, meso level and micro level, shows that research on audit quality has made great progress. Nevertheless, the literature review also

highlights three major challenges for research on audit quality. In particular, I have suggested that future research on audit quality should focus on the micro level, use of more diverse research designs and data sets, and examine auditors' competence. For each of these shortcomings, I have suggested potentially interesting research directions by transferring insights from other fields to the accounting context. I hope that the suggested research questions may stimulate future research to improve our understanding of audit quality, as well as the relevance of research on audit quality.

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**LEVERAGING ERROR TO IMPROVE AUDIT QUALITY:  
TOWARDS A SOCIO-COGNITIVE MODEL**

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### **ABSTRACT**

Despite extensive research on audit quality, the functioning within accounting firms still remains a ‘black box’. In this article, we open up the ‘black box’ by studying accounting firms’ organizational structures and practices in relation to a crucial aspect for audit quality: error management. We present findings of an in-depth case study of error management in a Big 4 accounting firm based on 18 months of participant observations and 38 interviews. Based on a grounded theory approach, we develop a socio-cognitive model that contributes both to the field of error management and to the field of audit quality. The socio-cognitive model shows how two different positions in the literature – the error prevention versus the error resilience approach – can be integrated into a more systemic socio-cognitive model. The socio-cognitive model accounts for the interaction between mental workings of auditors, error management practices, and feedback provided through structure and systems. Furthermore, the socio-cognitive model provides a comprehensive micro level model of audit quality and thus helps to gain a more complete understanding of how audit quality is produced in practice.

**Key words:** Audit Quality, Error Management, Socio-Cognitive Model



## INTRODUCTION

Recently, a German bank had to restate their financial statements by € 55.5 billion (Meck, Nienhaus, & von Petersdorff, 2011), equaling an amount more than double the GDP of Bolivia (World Bank, 2013). One reason for the restatement was a lack of audit quality provided by the accounting firm. Just how critical audit quality is for today's market economies becomes apparent when considering the consequences of accounting scandals like Enron (2001), Worldcom (2002) or more recently Lehman Brothers (2008). As a response to these accounting scandals, governments around the world have adopted wide-ranging regulations in order to improve audit quality. Also, the profession of public accountants responded with quality initiatives to protect the profession. However, an increasing complexity of business transactions and their underlying technology, a rapidly growing number of accounting standards, and fierce price competition among accounting firms are constant challenges for the production of high quality audits (Humphrey, Kausar, Loft, & Woods, 2011; Ronen, 2008).

Recent work has extensively researched audit quality from different levels of analysis. From a macro perspective researchers investigated the influence of legal regulations (Francis & Wang, 2008; Maijoor & Vanstraelen, 2006) and professional self-regulation (Grant & Bricker, 1996; Nelson, 2003). Furthermore, scholars have examined factors on the meso level such as accounting firm size (DeAngelo, 1981b; Francis & Yu, 2009), nonaudit services (Firth, 1997; Francis, 2006; Kanagaretnam, Krishnan, & Lobo, 2010), low balling (DeAngelo, 1981a; Lee & Gu, 1998), tenure (Carey & Simnett, 2006; Deis & Giroux, 1992; Myers, Myers, & Omer, 2003), client corporate governance (Karamanou & Vafeas, 2005; Lennox & Pittman, 2010), and industry specialization (Dunn & Mayhew, 2004; Owosho, Messier, & Lynch, 2002). However, little is known about the operations within accounting firms that lead to different degrees of audit quality (Francis, 2011; Hopwood, 1996). Thus, scholars have repeatedly called for research that goes inside the 'black box' of accounting firms to improve our understanding of audit quality from a micro perspective (Francis, 2011; Hopwood, 1996).

We respond to these calls by studying a crucial aspect in relation to quality: error management. Error management has been highlighted as a key for understanding the production of quality in research fields like high reliability organizations (Roberts, Stout, & Halpern, 1994; Rochlin, 1993; Weick, Sutcliffe, & Obstfeld, 2008), error management (Keith & Frese, 2008; Rybowskiak, Garst, Frese, & Batinic, 1999; Van Dyck, Frese, Baer, & Sonnentag, 2005), normal accidents (Perrow, 1984, 1994), safety culture (Hofmann &

Morgeson, 1999; Morgeson, Nahrgang, & Hofmann, 2011), and organizational errors (Edmondson, 1996, 1999; Edmondson, Bohmer, & Pisano, 2001). Jointly, these fields show how error prevention procedures and resilient error management approaches lead to varying degrees of quality. However, besides initial attempts to study error management in accounting firms (Gold, Gronewold, & Salterio, in press) our understanding of this crucial aspect is scarce.

On the basis of 18 months of participant observations, 38 interviews, and archival materials in a Big 4 accounting firm, we develop a grounded theory of error management in accounting firms. The resulting socio-cognitive model of error management differs from existing approaches and informs scholars in both the field of error management and the field of audit quality. First, our study offers a new theoretical model that pushes the general research agenda on error management from either an error prevention or an error resilience approach towards an integrated view on error management. We demonstrate how error prevention structures and systems in accounting firms create resilient individuals who are the key for resilient error management practices. This insight is in contrast to previous studies which assume that error prevention approaches inhibit a resilient error management approach. Second, the socio-cognitive model is the first comprehensive micro level model of audit quality. By transferring insights from other fields of research to the accounting field we provide a more comprehensive understanding of audit quality. Third, we link the ongoing error management debate with the audit quality discussion. Therefore, our research opens up a rich field for future research into error management in the financial industry, which ‘seems all the more called for in light of the financial meltdown in the first decade of the 21<sup>st</sup> century’ (Frese & Hofmann, 2011: 320). Jointly these insights demonstrate the value of opening up the ‘black box’ of accounting firms in order to improve our understanding of error management and audit quality.

The paper is structured as follows: We first frame the question of audit quality and error management in accounting firms. We then empirically investigate error management practices in a Big 4 accounting firm and show how individual cognitions and emotions interact with error management practices that are nested within organizational structures and systems. Finally, we integrate our findings into a more general socio-cognitive model of error management and discuss theories from the field of error management and audit quality.

## **THEORETICAL ORIENTATION**

### **Existing Approaches Towards Audit Quality**

The production of audit quality has been subject to extensive research in the field of accounting. Most of these studies follow DeAngelo's (1981b) initial definition of audit quality as the joint probability that a given auditor finds breaches in the financial statements and reports these breaches independently. This definition of audit quality highlights two crucial aspects for our understanding of audit quality: On the one hand auditors need to have the competency to find the breaches in the financial statements, and afterwards they need to report these findings independently. The approaches that have been taken to understand audit quality can be distinguished in studies taken on a macro level, a meso level, and a micro level.

On a macro level, scholars have described the influences of environmental characteristics on audit quality such as the legal environment and the influence of the profession. Studying the legal environment, Francis and Wang (2008) examined the influence of a country's investor protection regime on audit quality in 42 countries. In their study they find that audit quality is higher in countries with stronger investor protection regimes. Similar findings on the relevance of the legal regime on audit quality are reported from European countries (Maijor & Vanstraelen, 2006), studies of regime switches (DeFond, Wong, & Li, 1999; Venkataraman, Weber, & Willenborg, 2008), and studies using formal models to examine the effect of legal regimes on audit quality (DeJong, 1985; Schwartz, 1997). Moreover, researchers investigated the influence of professional self-regulation on audit quality. Their studies show that professional self-regulation may improve audit quality by clarifying accounting standards (Nelson, Elliott, & Tarpley, 2002) and enhancing the cooperation between auditors in relation to audit quality issues (Grant & Bricker, 1996).

On a meso level, scholars investigated inter-organizational and organizational factors associated with audit quality, which include client corporate governance, tenure, nonaudit services, industry specialization, and accounting firm size. Studies on client corporate governance revealed that audit committees improve audit quality thanks to the protective and coordinating function they take (Carcello & Neal, 2003; Collier & Gregory, 1996; DeFond & Jiambalvo, 1991; McMullen, 1996; O'Sullivan, 2000; Vafeas, 2005). Furthermore, research on audit tenure informed us that audit quality may increase with longer tenure thanks to an increasing competence of the incumbent auditor. Yet, increasing tenure also affects auditors' independence (Carcello & Nagy, 2004; Chen, Lin, & Lin, 2008; Myers et al., 2003). Moreover, the provision of nonaudit services by accounting firms has received considerable attention. These studies provide evidence that nonaudit services decrease audit quality, yet

this effect depends on auditor tenure, industry specialization, fee disclosure, and the audit/nonaudit fee ratio (Craswell & Francis, 1999; DeAngelo, 1981a; DeFond, Raghunandan, & Subramanyam, 2002; Frankel, Johnson, & Nelson, 2002; Kanodia & Mukherji, 1994; Kinney, Palmrose, & Scholz, 2004). Also, researchers have investigated the influence of industry specialization on audit quality, and stress its positive effect (Dunn & Mayhew, 2004; Solomon, Shields, & Whittington, 1999; Van Caneghem, 2004). Finally, research on the effect of accounting firm size highlighted the importance of economic incentives, production technology, and social capital as reasons for the relationship between an audit firm's size and audit quality (DeAngelo, 1981b; Francis & Yu, 2009; Lai, 2009).

On a micro level, initial studies reveal the importance of understanding the operations in relation to audit quality within accounting firms. Sutton (1993) investigated key activities in the audit process and highlighted the importance of effort allocation that leads to different degrees of audit quality. Similarly, Blokdiik and colleagues (2006) find that Big accounting firms allocate more effort to risk allocation, which allows them to perform more contextual audits. In this vein, Peecher and colleagues (2007) demonstrate how Big accounting firms altered their audit approach in order to enhance audit quality. Moreover, researchers started examining the influence of management control systems on auditors' actions. These studies provide evidence that performance evaluations, quality control systems, and time pressure strongly influence auditors actions in relation to audit quality (Coram, Glavovic, Ng, & Woodliff, 2008; Coram, Ng, & Woodliff, 2004; Malone & Roberts, 1996; Sweeney & Pierce, 2004).

An important contribution of these studies focusing on the micro level is that they highlight the interaction of organizational structures and systems, organizational practices, and individual behaviors. Malone and Roberts (1996) emphasize the interaction of the quality management system and individual auditors' actions by showing how an effective quality management system can prevent auditors from committing reduced audit quality behaviors. Similarly, Pierce and Sweeney (2004) show how auditors' actions on audit quality are affected by the time budget. These insights are complemented by Covaeski and colleagues (1998) who demonstrated the interaction of organizational principles, such as management by objective and mentoring, with auditors' actions within accounting firms. Nevertheless, studies on all three levels – macro, meso and micro – have yielded important insights for our understanding of audit quality and have established an important field of research into quality in a particular professional service setting.

### **Critique of Existing Approaches**

Despite advances in the field of audit quality, our current understanding of audit quality is still incomplete. The majority of studies on audit quality view the outcome of audits as a function of contextual factors on the macro and meso levels (Francis, 2011). Furthermore, these studies have focused on the independent reporting of auditors, while the competence of auditors has been widely neglected. Hence, although there are initial studies on the micro level, the operations within accounting firms have not yet been considered comprehensively. Thus, Hopwood lamented early on that ‘within the audit firms themselves we still have very inadequate insights into their modes of functioning and the consequences of these for the audit task. [...] many of the most significant organizational and management characteristics of the modern audit firm are little understood. Too much of the practice and functioning of the auditing remains a ‘black box’ ’ (Hopwood, 1996: 217).

This relative neglect of the operations within accounting firms is surprising, since most other fields related to quality have stressed its importance. The relevance of operations has been highlighted in research on high reliability organizations (Roberts, Rousseau, & La Porte, 1994; Rochlin, 1993; Weick et al., 2008), error management (Keith & Frese, 2008; Rybowskiak et al., 1999; Van Dyck et al., 2005), normal accidents (Perrow, 1984, 1994), safety culture (Hofmann & Morgeson, 1999; Morgeson et al., 2011) and organizational errors (Edmondson, 1996, 1999; Edmondson et al., 2001), and total quality management (Douglas & Judge Jr., 2001; Hackman & Wageman, 1995). Despite discrepant approaches, views, and nuances in definitions these fields, all agree that the operations are a key to understanding the production of service quality.

Consequently, there have been repeated appeals that we should give greater attention to the operations within accounting firms to gain a deeper understanding of audit quality. In a recent literature review on audit quality, Francis (2011) repeated Hopwood’s earlier call to open up the ‘black box’ of accounting firms by noting that ‘research on the relation between accounting firms and audit quality is severely limited by the availability of data on characteristics of accounting firms. To date, research on this topic has relied on variables that can be constructed from public disclosures such as client-based measures of industry expertise and office size. However, these measures do not go inside the ‘black box’ of the accounting firm’s organizational structure and operations’ (Francis, 2011: 138). Our research aims at exploring the ‘black box’ of accounting firms’ operations by transferring insights from other fields interested in the topic of quality, safety, and reliability.

### **An Error Management Approach Towards Audit Quality**

Research fields related to managing quality, safety, and reliability all agree that the key for understanding quality is error management (Goodman et al., 2011). We broadly define error management as actions taken in organizations to prevent errors from occurring and to deal with errors appropriately after their occurrence. In relation to audit quality, error management becomes particularly relevant for three main reasons. First, errors are in direct conflict with audit quality because they may lead the auditors to false conclusions. Thus, preventing and dealing with errors before they are compounded becomes essential (Cannon & Edmondson, 2005). Second, errors stimulate learning on the individual, team and the organizational levels, because they provide clear signals that something is wrong and has to be changed (Argyris, 1999; Edmondson, 1999; Sitkin, 1992; Van Dyck et al., 2005). Thus, error management becomes crucial for the competence of individual auditors, audit teams, and accounting firms to provide high quality audits. Third, research suggests that errors occur particularly often during audit engagements because of high workloads, strong time pressure, quick changes between tasks, the need to learn new things, complex technology, varying customers, and high coordination demands (Keith & Frese, 2010). Taken together, these arguments suggest that error management in accounting firms seems to be a key for understanding the bigger question of audit quality.

Previous research on error management can be subdivided into two basic approaches towards errors – error prevention and error resilience. On the one hand, scholars taking an error prevention approach argue that quality is best achieved by preventing errors from occurring in the first place. The underlying assumption is that organizations can identify and define all risks and events that must not happen, and then create a set of procedures for preventing them (Weick et al., 2008). As a result, organizations should implement ‘design rules and standard operating procedures, provide training, carry out audits and inspections to enforce compliance [, and] develop contingency plans’ (Goodman et al., 2011: 165). In case of adverse events, contingency plans are used to address them, and error prevention procedures are adjusted after failures occurred (Goodman et al., 2011). Thus, the error prevention approach views error-free performance as feasible and suggests that quality is the outcome of a lack of variance in respect to predefined norms, rules, and procedures (Goodman et al., 2011; Weick et al., 2008).

On the other hand, scholars taking an error resilience approach argue that quality is best achieved by flexibly reacting to adverse events (Reason, 1990; Van Dyck et al., 2005). The underlying assumption is that ‘error and organizing go hand in hand’ (Weick, 2012: 160).

As a result, organizations should promote climates of psychological safety to facilitate communication about errors (Edmondson, 1999), and build vigilance and improvisation skills to initiate fast response to errors and involve participants to develop capabilities in process improvements (Goodman et al., 2011). This approach opposes the error prevention approach by suggesting that ‘unvarying procedures can’t handle what they didn’t anticipate’ (Weick et al., 2008: 35). Thus, the idea that predefined ‘routines are the source of reliability conflates variation and stability and makes it more difficult to understand the mechanisms of reliable performance under trying conditions’ (Weick et al., 2008: 35). As a result, there is a great divide between those scholars taking an error prevention and those taking an error resilience approach.

Despite these contradictions, the opposing camps agree that one main challenge to effective error management lies on the individual level. Research suggests that effective error management is severely impeded by three human characteristics. First, humans tend to make efforts to avoid embarrassment, feeling vulnerable, or incompetent (Argyris, 1976; Cannon & Edmondson, 2001; Maister, 1993). Consequently, people are less inclined to communicate errors openly (Zhao & Olivera, 2006). This inhibits early error detection and error handling. Second, experiments show that humans have difficulties in identifying errors correctly within complex cause-and-effect chains (Dörner & Schaub, 1994). Therefore, error detection and error handling is impeded. Third, research suggests that humans prefer to analyze successes rather than errors (Reason, 1990; Sitkin, 1992). Thus, error learning is severely limited in organizations.

Taken together, the insights from the camps of error prevention and error resilience suggest that error management is a phenomenon that involves multiple levels of analysis. The error prevention approach has mainly stressed the relevance of organizational structures and systems, as well as procedures to prevent errors (e.g. organizational design rules, standard operating procedures, training). On the other hand, the error resilience camp has stressed the interaction within organizational structures, and highlighted the relevance of social practices and norms (e.g. psychological safety, error management culture, processes of mindfulness). And both streams highlight the difficulties the individual has in preventing errors and responding to them resiliently. Thus scholars in the field suggested to take a multi-level approach towards investigating error management (Goodman et al., 2011). They suggest that ‘to study the relationship between individual and organizational errors requires a deep understanding of the work and social interactions occurring within the unit’ (Goodman et al., 2011: 160). They continue by suggesting that ‘a strong ethnographic approach with

observation and interviews over time is necessary to uncover both explicit and implicit learning. During such an investigation, one wants to understand individual perceptions, shared understandings, and structural indicators of the switch from individual-level errors to a shared understanding in a unit or organization about deviating from standard operating processes. This deeper research approach generates different insights than the survey methodology used in most error-related research, and would be helpful for understanding error correcting and error amplifying processes as well' (Goodman et al., 2011: 160).

This call is complemented by a suggestion of Frese and Hofmann (2011) to transfer our insights into error management from other previously investigated industries with 'high physical or environmental risk (e.g. nuclear, manufacturing, health care, oil and gas)' (Frese & Hofmann, 2011: 320) to the financial industry. They state that 'the migration and application of these concepts to the financial industry seems all the more called for in light of the financial meltdown in the first decade of the 21<sup>st</sup> century, which, by all accounts, resulted from a mélange of errors and violations as well as insufficient organizational approaches to risk issues' (Frese & Hofmann, 2011: 320). In our study, we respond to these suggestions of scholars in both the field of error management and the field of audit quality, and approach the investigation of error management in accounting firms with a case study approach.

## **RESEARCH DESIGN**

We chose a case study approach (Yin, 2003) to investigate error management in one Big 4 accounting firm. The case study approach helped us to explore error management within the natural context by collecting context-rich data and gaining insights into the complex interaction on multiple levels of analysis (Edmondson & McManus, 2007; Eisenhardt, 1989; Yin, 2003). We chose a Big 4 accounting firm mainly for two reasons. First, a number of studies have argued theoretically (DeAngelo, 1981a, 1981b) and provided empirical evidence (Becker, Defond, Jiambalvo, & Subramanyam, 1998; Francis & Krishnan, 1999) that Big accounting firms provide higher quality audits than non-Big firms. Second, and related to the first argument, scholars found that Big accounting firms exhibit more clearly defined organizational structures and management practices than non-Big accounting firms (Covaleski et al., 1998; Dirsmith & Covaleski, 1985; Scandura & Viator, 1994). Thus exploring the influence of organizational principles and management practices on individual actions in relation to error management is more pronounced in these extreme cases, and thus more adequate for theory building, than in other non-Big accounting firms that appear to represent the average firm and behavior (e.g. Starbuck, 2006).



## **Data Collection**

One of the investigators in this study worked for three years part time within a Big 4 accounting firm, which we refer to here as The Firm. This gave us, as a research team, ‘unique access’ to rich data of The Firm’s organizational structures, systems, and practices. We took advantage of this ‘unique access’ to use three main strategies for data collection: participant observations, semi-structured interviews, and document analysis. The use of multiple techniques helped us to view the phenomena within The Firm from different perspectives. This triangulation technique has been widely suggested by other scholars (Eisenhardt, 1989; Jick, 1979; Yin, 2003) and supported the grounding of our findings within the data.

***Participant observations.*** A primary source of data collection was participant observations which involved actively working within audit teams. This technique allowed us to gain an intimate familiarity with the functioning of audit teams in real time. Moreover, working alongside informants helped us to build up trust with colleagues (Yin, 2003). This mutual trust, as well as the intimate familiarity with The Firm’s value system and language, proved to be essential for the open discussion of errors with the auditors. In total, during our study we have actively worked in, and observed colleagues in, 14 audit teams. The total time spent in audit teams was about 18 months over a time period of three years. The number of members of the different teams varied from three to twelve of the core audit engagement team. Working within these teams included working at the offices of various clients. This gave us a natural opportunity to constantly contrast operations within The Firm and other organizations.

***Interviews.*** A second source of data was semi-structured interviews. Following theoretical sampling (Glaser & Strauss, 1967), we built in different instances to find variations in the data to explain emerging patterns of error management. We selected instances along various dimensions such as the rank of interviewees, team, office, nationality, and service line. We chose to interview auditors from different ranks to develop a comprehensive understanding of the operations within accounting firms from different perspectives. Different teams were chosen to single out team particularities. We interviewed auditors from a variety of offices within Germany, as previous studies reported varying levels of audit quality in different offices within the same national practice (Choi, Kim, Kim, & Zang, 2010; Francis & Yu, 2009). We also interviewed auditors from other national practices to control for national peculiarities. These auditors came from countries as diverse as the UK, Singapore, Ireland, Austria, Switzerland, Italy, the Netherlands, the Czech Republic, and India. In total, we

conducted semi-structured interviews with 30 auditors across all levels of seniority from 12 offices in 10 countries. Additionally, we interviewed seven management consultants from The Firm. This gave us the chance to compare the answers from the auditors with those from another group of knowledge workers (Alvesson, 2001) to sharpen our understanding of different error management practices. Additionally, we interviewed the head of quality and risk management for Germany, Austria and Switzerland to get a more high level understanding of operations within The Firm.

The initial interviews were conducted with the help of a semi-structured question guideline. The questions were taken from questionnaires previously suggested for the study of high reliability organizations (Weick & Sutcliffe, 2001), error management culture (Van Dyck et al., 2005), and individual error orientation (Rybowiak et al., 1999). After the first ten to fifteen interviews, we reached a point of theoretical saturation for most themes indicated by the questionnaire. Thus, we started further exploring emerging themes that had developed during the participant observation and during prior interviews (Glaser & Strauss, 1967). A common feature of all the interviews was that we started off with a broad question. This technique, as for example suggested and used by Edmondson (2003), proved to be very helpful in allowing the emergence of new themes before limiting informants' responses with specific questions (Edmondson, 2003). Looking back, the interviews strongly supported our understanding of the relationships between structures, practices and individual behaviors. All interviews were tape-recorded and fully transcribed to facilitate the analysis of the data. The following table provides an overview of the number of interviewees according to service line and rank:

**TABLE 2:**  
**Number of Interviewees According to Service Line and Rank**

<b>Service Line</b>	<b>Rank</b>	<b>#</b>
<b>Audit</b>	Partner	4
	Senior Manager	3
	Manager	5
	Senior	9
	Junior	9
<b>Consulting</b>	Partner	1
	Senior Manager	1
	Senior	1
	Junior	4
<b>HR</b>	Manager	1

*Archival materials.* Additionally to the participant observation and the interviews, we collected relevant archival materials about The Firm's operations. These documents were mainly provided through the global internal database of The Firm. The documents we gathered included a description of the quality and risk management system, charts about the organizational structure, practice manual, code of conduct, training materials, learning and development plans and staffing plans. Besides providing us with a clearer picture of the organizational operations, these documents also provided more exact and unobtrusive information about the context in which auditors operate (Yin, 2003). According to our comparative approach, this information was also useful in uncovering new themes, as well as validating information gathered throughout the participant observation and interviews.

### **Data Analysis**

The data analysis followed a Grounded Theory approach initially suggested by Glaser and Strauss (1967) and further developed by Strauss and Corbin (1990; 1998). Starting with the collection of data, it followed an iterative process of travelling back and forth between the data and emerging structure of theoretical arguments. This continuous comparison occurred concurrently with the data collection and helped to carve out dominant concepts. These

concepts in turn were taken to form more abstract categories, which were the building blocks of the emerging theory (Isabella, 1990; Suddaby, 2006).

The process of data analysis was a truly iterative process of collecting, reflecting on, analyzing, and collecting new data. Nevertheless, the analysis can roughly be described as follows. In a first step, field notes and interviews were open-coded in respect to error management. On this basis we developed a list of emerging themes. The qualitative data-analysis software Atlas.ti 6.0 assisted in this iterative process of coding, analyzing, and recoding. Subsequently, we reduced the list of themes and grouped passages from different interviews, observations and the archival documents that referred to the same theme. In a second step, we refined our analysis by focusing on practices that enabled audit teams to anticipate and quickly handle occurring errors. This second phase of coding revealed five distinct practices. Auditors described ‘a constant struggle to know what is happening within the team’ and they asserted that ‘communication is essential to catch errors early on’. We abstracted these cues into the more abstract category of *realizing what is going on*. A second pattern that emerged was the ‘need to double check’ and the importance that something is ‘triangulated’. These patterns we abstracted to the construct of *taking multiple perspectives*. Furthermore our interviews were scattered with quotations like ‘you simply have to stay calm when errors occur’ and ‘you have to save the situation first’. We grouped this pattern into the construct of *cool-headed error handling*. A fourth pattern that emerged through descriptions of how issues are ‘pushed around within the team’, and the notion that ‘everything could be handled, because there is somebody at The Firm who will know about it’, were abstracted to the error management practice of *informed decision making*. Furthermore, we found a particularly strong sense of ‘skepticism’ among auditors. In the language commonly used by auditors, we labeled this practice as *exerting professional skepticism*.

In a third step, we used these five resilient error management practices as a starting point to understand what leads to the formation and reproduction of these practices. Revisiting the initial codes revealed that individual skills of auditors were the basis for the resilient error management practices. Using expressions like ‘you get an awareness that errors happen all the time’, ‘I have made errors all the time’, ‘we have to accept that errors happen in our work’, and ‘there will always be wrong decisions’, auditors described their awareness of errors. We clustered this realistic sense of the ubiquity of errors to describe individual *error humility*. Furthermore, auditors reported that they had experienced ‘an emotional blunting over time’ and frequently referred to a ‘soundly relaxed way’ of senior auditors. Comparing these insights with literature on emotion, we labeled this pattern as *emotion regulation*.

Interestingly, both patterns of *error humility* and *emotion regulation* were very pronounced and seemed to be shared by all the auditors that we interviewed across countries as diverse as Germany, the Czech Republic, France, the UK, Ireland, Singapore, and India.

In a fourth step, which was interrelated with our second step, we tried to understand what leads to the development of *error humility* and *emotion regulation* over time. As these topics occurred frequently within our interviews, we directly asked the interviewees about their thoughts. Reanalyzing the answers to these questions revealed that these developments were a direct consequence of being constantly confronted with small-scale errors at work. For example, auditors mentioned that ‘reviews constantly point out the errors you make’. Furthermore, they explained that ‘you are always changing teams, tasks and clients, so there is no chance of not making mistakes’. Also, auditors told us that ‘through feedback your strengths and weaknesses are pointed out to you’. Through further discussion with the auditors and further participant observation, it became clear that the practices that lead to the development of *error humility* and *emotion regulation* were constant *reviews*, *job rotation* and *feedback*. Reflecting upon these insights, we realized that these practices were direct outcomes of the organizational design, most notably the *quality and risk management system*, *learning and development plans* and the *multidimensional matrix* organization.

In our final step, we further aggregated and abstracted our thematic constructs into a theoretical framework that describes and explains error management in accounting firms. We grouped the constructs of *realizing what is going on*, *taking multiple perspectives*, *cool-headed error handling*, *informed decision making*, and *exerting professional skepticism* as being *resilient error management practices*. On the individual level we grouped *error humility* and *emotion regulation* as key characteristics of *resilient individuals*. Furthermore, *reviews*, *job rotation* and *feedback* were grouped as *error prevention practices*. Finally we grouped the *quality and risk management system*, *learning and development plans* and the *multidimensional matrix* as *error prevention structures* of The Firm.

To ensure the reliability and credibility of our study, we maintained a practice of rigorously questioning the interpretations throughout the analysis by engaging two independent researchers in order to ensure that emerging categories are grounded in the data. Whenever conflicts in coding and categorization occurred, we discussed these instances and went back to the data in order to substantiate the claims with documentary evidence. In addition, we employed a practice of peer debriefing, which encompasses the engagement of other experienced researchers not directly involved in the study to serve as a devil’s advocate and give feedback about the data collection and analysis. Peers were department members as

well as other researchers who gave feedback at different stages of the study. Furthermore, after writing up our case study and the resulting theoretical framework, we provided the findings to several auditors on different hierarchical levels (one partner, one manager, and two seniors) to receive feedback. We integrated their suggestions to further strengthen our case study and the theoretical framework. Nevertheless, all auditors agreed with the overall description of the case study, as well as with our theoretical framework.

## **THE CASE STUDY**

### **The Accounting Industry: Growth and Regulation**

Accounting firms are crucial for today's economies because they 'underpin the integrity of financial markets [and] enable complex international transactions' (Greenwood, Morris, Fairclough, & Boussebaa, 2010: 173). Consequently, governments have adopted wide-ranging regulations to prevent audit failures. Prominent examples of these regulations are the Sarbanes-Oxley Act in the United States and the Green Paper initiative in the European Union. The Sarbanes-Oxley Act of 2002 sets enhanced standards for all US public company boards, management, and public accounting firms as a reaction to major corporate and accounting scandals like Enron and Worldcom. The act covers issues such as auditor independence, corporate governance, internal control assessment, and enhanced financial disclosure (DeFond & Francis, 2005). Similarly, the EU Green Paper on auditing suggests a stricter regulation to enhance audit quality by strengthening auditors' independence, increasing competition between audit firms, and decreasing the expectation gap of audits (European Commission, 2010). Furthermore, the profession of public accountants responded with quality initiatives in an attempt to protect the integrity of the profession (e.g., Code of Ethics for Professional Accountants, International Standard on Quality Control, International Education Standards) (International Auditing and Assurance Standards Board, 2013; International Ethics Standards Board for Accountants, 2010).

Interestingly, within this rigid regulatory environment designed to prevent audit failures, the Big 4 accounting firms have emerged as the most flexible, attentive, and largest organizations that we know. As Greenwood and colleagues (2006) argue, professions have adapted well to the new bureaucratic governance regime in the accounting industry and some accounting firms have grown fast to become some of the largest firms worldwide in terms of size and geographical scope. In 2012, PricewaterhouseCoopers (PWC) with over 180,000 employees, \$31.5 billion (US) in revenue, and 776 offices in more than 158 countries

worldwide (PWC, 2013) had a stronger global reach than the majority of corporations such as Wal-Mart (operating in approximately 10 countries), General Motors (in 51 countries), or Ford (in 132 countries) (Greenwood et al., 2006). Moreover, the largest accounting firms have been on a continuous growth path. Ernst & Young, for instance, doubled its number of employees and increased its revenue nearly fivefold between 1980 and 2000 (Greenwood et al., 2006).

### **The Firm: Structure and Systems**

*'We are world champions in matrix organizing'*. The Firm belongs to the top-tier firms in its industry with operations in a large number of countries worldwide. Like most of its large competitors, the organizational structure of The Firm can be described as a multidimensional matrix organized according to geographical locations, service lines, and industries. While these different dimensions create tensions within the organization, for instance, between service lines fostering particular professional standards and industries emphasizing local market knowledge and growth, it also creates a responsive and adaptable organization. Dealing with the multidimensionality of a matrix means in practice that these different dimensions cannot coexist in different static organizational forms, but rather require sustained engagement, negotiation, and to some degree competition among them. Knowledge and decision-making is highly distributed, which allows The Firm to accommodate management structures to the problem-solving capacity available within the organization and adapt to changing circumstances quickly (also see Greenwood et al., 2010; Reihlen & Mone, 2012).

The matrix structure as the main coordination device is complemented by a clearly defined ranking hierarchy<sup>1</sup>. Across all service lines, ranks are subdivided into the ranks of assistants, seniors (team leader), managers, senior managers, and partners. All ranks have clearly defined expectations communicated through training courses, the yearly goal setting meetings, and through internal communication systems. While partners are in charge of multiple audits each year, develop the business with clients and develop practice area through initiatives within the organization, lower-ranked employees are expected to professionally manage and execute audit projects. The interesting feature of The Firm's organization is that the ranking hierarchy is not so much a coordination instrument, as more a device for disciplining and incentivizing employees through advancement and competition over

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<sup>1</sup> We borrow Masahiko Aoki's (1990) term *ranking hierarchy* from his description of the nature of the Japanese firm as it parallels the organizational incentive structure of The Firm. Aoki, M. 1990. Toward an economic model of the Japanese firm. *Journal of Economic Literature*, 28(1): 1-27.

hierarchical ranks. In other words, The Firm like most of its peers combines the matrix form as the main coordination structure with a ranking hierarchy as a particular incentive system. The ranking hierarchy is further reflected in the Learning and Development Plan explored next.

***‘Learning and Development Plan’.*** The Firm engages heavily in training and retraining of its professionals. The training activities within The Firm follow different formats such as ‘training off the job’ (training sessions), ‘training on the job’ (coaching in the audit teams), and ‘training near the job’ (training others in training sessions). All of these training elements are planned for each employee in a clearly structured ‘Learning and Development Plan’. The ‘Learning and Development Plan’ at The Firm can best be illustrated by sketching the ‘Learning and Development Plan’ of an individual auditor. Auditors usually start working at The Firm in September, which is right before busy season. The first four weeks are used for ‘induction training’. This ‘induction training’ includes training of the ‘audit approach’, ‘basics of accounting’, ‘basics of taxation’, ‘basics of valuation’, and ‘working with the client’. Right after these training sessions the young recruits are sent on their first audit engagements. During the busy season they learn on the job to apply the knowledge they have learned during their studies and their first weeks of training. Additionally, the other team members coach junior auditors while working together on the audit engagements. Following the first busy season, the auditors engage in off-the-job training again. In the second and third years, ‘off-the-job training’ in more technical matters continues. Furthermore, it is increasingly complemented by adding soft-skill training like ‘leading a team’, ‘team presentations’, and ‘job organization’.

After the first two years of intensive internal training, auditors at The Firm are asked to take the certified-tax-advisor exam in the fourth summer and the chartered-accountant exam in the fifth or sixth summer. Both exams are considered to be among the most difficult exams in Germany, with a high failure rate for the first attempt. After passing these exams, auditors are asked to train younger colleagues through training sessions, which is called ‘training near the job’. While the training intensity is highest during the first four to five years, training sessions are an integral part throughout the career at The Firm and are manifested in its ‘Learning and Development Plans’. As a result, specific role expectations and learning stages are standardized for each position and rank. Employees with predefined skillsets can thus easily be staffed on all kinds of audit engagements, anywhere, anytime in the world. Or to put it in the words of a senior partner: ‘everybody in our firm is replaceable anytime’ and The Firm’s ‘Learning and Development Plan’ is the tool that makes this human substitutability possible.



***‘Quality and Risk Management System’.*** Delivering high quality services and managing risks carefully are considered the backbone of The Firm’s strategy and long-term survival. The Quality and Risk Management System (QRM) has become one of the core systems within The Firm, guiding the measuring, monitoring, and acting upon quality and risk issues. Following its mission ‘to protect the clients, our organization, and our brand’, QRM practices become omnipresent on all levels: the organization, the team, and the individual practitioner. On the organizational level, the objective of quality control ‘is to establish and maintain a system of quality control to provide it with reasonable assurance that: (a) the firm and its personnel comply with professional standards and applicable legal and regulatory requirements; and (b) reports issued by the firm or engagement partners are appropriate in the circumstances’ (International Auditing and Assurance Standards Board, 2012b: ISQC 1, para. 11). Responsibilities for developing and maintaining the QRM belong to a core team of partners who are distributed worldwide but operate as an organizationally integrated whole. Their task is to infuse the organization with high level quality and risk management practices. On the engagement level, the general objectives of the QRM are translated into team objectives such as ‘(a) the audit complies with professional standards and applicable legal and regulatory requirements; and (b) the auditor’s report issued is appropriate in the circumstances’ (International Auditing and Assurance Standards Board, 2012a: ISA 220, para. 6). While each engagement team member is responsible for his or her own task, the final responsibility is with the partner and the manager who sign the audit report. Finally, on the individual level The Firm promotes ethical standards in order to control the ‘integrity’, ‘objectivity’, ‘professional competence and due care’, ‘confidentiality’, and ‘compliant professional behavior’ of individuals, and fosters their skill development through constant training.

### **The Quality Control Procedures**

***Working paper reviews.*** The most prominent element of the QRM in the work of auditors is the working paper review. Working paper reviews are an ongoing procedure during audit engagements. Whenever an audit procedure has been ‘prepared’ by an auditor, a more senior auditor has to ‘review’ the working papers. This preparation and reviewing procedure is documented either on the physical working papers or in the electronic auditing software. The main objective of working paper reviews by a superior team member is ‘to identify possible errors not detected by the subordinate auditor’ (Owhoso et al., 2002: 884).

Our data revealed that auditors have an ambivalent attitude toward these reviews. Within the audit teams, working paper reviews are usually done at the end of one of the four auditing phases – planning, audit strategy development, execution, and wrap up. At this point a senior auditor asks ‘what’s ready to be reviewed’. During the time that he or she reviews the working papers, we observed that the reviewed auditor has a keen awareness of all signals of the senior auditor that might indicate found mistakes. This worry is understandable, since the senior auditor rates the performance of the junior auditor. At the end of the review the reviewer usually hands over a review sheet with a (long) list of issues that have to be addressed. These (long) lists of review points are usually ‘concerning’ and even ‘frustrating’ for younger auditors. While this is considered ‘perfectly normal’, the process of getting used to these critical reviews, however, takes time and never really disappears completely. When discussing the review process in one of our interviews, a senior auditor expressed his experiences as follows:

‘At the beginning I was really concerned when I handed in an audit report for review to the manager and the partner, and I got it back all red. But, as you know, after a while you really get used to it. It’s simply not possible to get everything right and you know ... everyone makes mistakes.’

**Feedback.** An integral part of the learning and development within The Firm is direct feedback within the audit teams. Auditors are constantly encouraged to obtain feedback for their performance on the job. The performance feedback covers strengths and weaknesses and are ‘linked to promotions, salary and the assignment of appropriate tasks’. Within The Firm auditors are given feedback on a regular basis. For each project greater than 80 hours, auditors can request feedbacks from their supervisors. The resulting feedback reports are provided in a written form and discussed with the engagement manager. Requesting feedback is incentivized by linking the number of obtained ‘feedback reports’ to the individual year-end bonus scheme. The job feedbacks are complemented with a discussion of the job feedbacks taking place every six months with a ‘counselor’ about ‘personal development’. All feedback reports and the resulting bonus are discussed with the counselor and a partner in a year-end discussion.

Like the working paper reviews, feedback within The Firm was regarded very ambivalently. On the one hand, everybody agreed that ‘feedback is important’, and ‘feedback helps’ which is usually expressed in concerns like ‘I would like my supervisor to give more feedback’. On the other hand, especially junior auditors seemed to be afraid of actually asking

for feedback. The fear of feedback was particularly apparent in the practice of postponing feedback reports. Especially junior auditors had the tendency to delay the request of written feedback reports to the latest possible date. Mostly this postponement practice was justified with arguments like ‘there is too little time to do it’. However, this lack of time was only part of the explanation, since requesting feedback took no longer than two to five minutes. Rather, the postponing was a result of a deliberate strategy of what one partner called ‘cherry picking’: junior auditors waited for other jobs to run more smoothly and to request feedback from these cherry-picked jobs. However, as auditors expressed their concern that they ‘never can do a 100% because of the time pressure’ this practice of postponing the request of feedback reports continued ‘until there is no other way than requesting feedback reports’.

**Job rotation.** The flexibility of the matrix structure is the basis for a constant job rotation within The Firm. Job rotation means that auditors work on changing jobs. The example of the job rotation of a junior auditor illustrates the principle of constant job rotation. During a busy season of six months, a junior auditor works on five to ten audit engagements. The constant job rotation confronts auditors with continually working in new teams, with new colleagues, at new sites, with new client personnel, and in new industries. Additionally to this constant job rotation, auditors take on new responsibilities each year according to their new roles within the hierarchy. This means for auditors that even if they stay at the same audit engagement, they will be assigned new tasks that they have not performed before. Within The Firm rotating the audit teams is considered to be important to ‘quickly develop juniors’ and to take ‘fresh perspectives’ on auditing issues. Furthermore, this constant job rotation has been identified as a key distinctive feature of Big in comparison to non-Big accounting firms in our interviews. While this job rotation is most pronounced in the first five years, it continues throughout the whole career of auditors.

Particularly, our interviews revealed that this constant job rotation is liked and disliked at the same time. On the one hand auditors have repeatedly expressed that they like the ‘new challenges’ and ‘working with other colleagues’ and the resulting ‘steep learning curve’, which one partner described in an interview as follows:

‘One thing that I always liked about the job is that you never stop learning. You are always confronted with new challenges.’

On the other hand, auditors have complained about the difficulties that arise from constant job rotation. Most importantly, junior auditors described the situation that they can never do something ‘properly’ or ‘you never have the time to fully understand something’.

However, this ambiguity toward constant job rotation and ever-changing tasks has also been described as being ‘stressful’ by senior auditors and partners. One senior manager told us that:

‘But sometimes, you know, you think about how it would be when you had a bit more steadiness in our job, not always new tasks and all this stuff. Just a bit more quiet.’

### **The Auditor: Mindset and Emotions**

Our case study revealed that auditors perceived errors as a normal – but disliked – part of work. In the interviews auditors constantly used phrases like ‘to err is human’, ‘we make mistakes all the time’, ‘I am sure that I have been committing errors always’ or ‘I approach things with the knowledge that I know that I will make mistakes’. However, we found that this awareness and acceptance of errors was crucial in the work of auditors, because it was the basis for anticipating errors during audits. We noticed that this awareness of errors was the reason for demonstrating a high degree of self-reflectivity in their own decisions. Closely connected to this awareness of one’s own fallibility was the skepticism developed by auditors towards things that ‘went too well’. As one manager illustrates:

‘Last week a senior came to my office, he told me that he had finished the job one day ahead of time. Immediately, I got worried.’

When dealing with errors, we found a distinctive pattern of personal development in the 18 months of participant observation. At the very start of their career, junior auditors face very hectic and emotionally difficult situations starting with the first busy season: while trying to do their best to avoid mistakes, they also face constantly changing working contexts through job rotations and equivocal audit tasks making it difficult to perform error-free and, at the same time, they are subject to permanent reviews and feedbacks creating a high degree of personal stress. However, this first emerging stage evolves over time into a maturing stage in which auditors develop a calmer and more reflective attitude when facing errors. The development towards a calmer and more relaxed approach was described by one manager like this:

‘Over time you somehow experience an emotional blunting when something goes wrong.’

Interestingly, within The Firm auditors even have a name for this soundly relaxed attitude – they call it ‘Tiefenentspanntheit’ (deep relaxation). This ‘Tiefenentspanntheit’ was a key characteristic of auditors that we found throughout our participant observation and our interviews. The ‘Tiefenentspanntheit’ is characterized by a strong tendency to keep negative emotional reactions low whenever faced with something that went wrong. Within the audit team this ‘Tiefenentspanntheit’ was particularly useful because it enabled senior auditors to react quickly to adverse events. One partner expressed it like this:

‘If I got upset every time an error occurs then I would be doing nothing else. There are so many things that could upset you. ... It doesn’t help. You always have to look forward and tell yourself: OK, what are we going to do now in this specific situation?’

### **The Interaction within Audit Teams**

**‘Realizing what is going on’.** The work within audit teams is characterized by constant communication. Seniors have frequently said that constant ‘communication is essential for the success of an audit’. Communication is used both as a means to catch bigger issues early on, and to handle actual errors effectively. Therefore, senior auditors continually described a need to have a constant awareness of ‘what is going on within the team’, ‘what are the issues’, ‘where are the strengths and weaknesses of team members’, and ‘do junior team members actually understand what they are doing’. This struggle to realize the issues within the team is also reflected in the feeling of team leaders, who have described ‘an awkward feeling when somebody does not ask a question for a while’. This communication, however, is not only limited to the team on-site. Constant communication with the manager can be witnessed within the teams that are in constant contact with the manager via phone or email. As one partner expressed:

‘Because all the things that can go wrong can be identified through quick communication. So I think, the worst that can happen when you are a Manager or a Senior, or whatever, is that others do not clearly communicate how far they are, what they struggle with, and what they do understand and what they do not understand.’

**‘Taking multiple perspectives’.** The relevance of taking multiple perspectives is omnipresent in auditing. On the team level, ‘taking multiple perspectives’ can best be witnessed in the different views taken by the different roles of the members of an engagement

team. While senior auditors initially set up the audit strategy, more junior auditors take a more detailed view by investigating processes, the internal control system and by collecting detailed audit evidence for individual accounts. Already within the on-site team, the senior is expected to take a holistic view on the financial statements by taking a more high-level perspective. This more holistic perspective includes the triangulation of the conclusions of junior auditors with one's own insights from analytical procedures, and discussions with management to find errors in the conclusions of junior auditors. The manager takes an even higher-level perspective and tries to identify weaknesses within the audit strategy adopted by the engagement team. Moreover, partners challenge the conclusions of the engagement manager. In addition, for higher-risk audits the final conclusions of the engagement team are challenged by an independent reviewer, as well as expert reviewers. While the independent reviewer brings in new insights from other clients and ensures that organizational blindness does not decrease the quality of the audit, the expert reviewer is an expert in a specific field (e.g. IFRS) and challenges the conclusions within his field.

*'Saving the situation first'*. When errors occurred, auditors appeared to be extraordinary calm and action-oriented. One example from our participant observation may illustrate the practice of 'saving the situation first'. On one engagement the manager reviewed the general audit strategy of the audit team. Suddenly, he noticed that one important aspect had not been addressed. Everybody in the team knew that this was a huge mistake. However, the conversation about this mistake was very calm – in order to 'save the situation first'. The conversation went like this. The audit manager addressed the issue by casually throwing into the group: 'Was there actually a reason that *we* have never audited the sales process of this subunit?' The senior immediately responded by asking in a calm manner: 'What's the sales volume of this subunit?' to determine the consequence of the mistake. One of the assistants jumped in to answer the question. Since the sales volume was a significant part of overall sales, the senior continued calmly 'Yeah, actually, I think we have to have a look into this process.' This was followed by the manager calmly replying 'Yes, I think we should do so.' Then the senior asked one of the assistants to audit the process. Considering that this was a serious mistake which popped up after all auditing of the processes had already been finished, the calm manner in which the team talked about it and straightaway went on to address the issue was quite remarkable.

Another practice we observed and that ran throughout our interviews was the discouragement of blaming other team members for errors. When we asked a Singaporean manager – who had also worked in the UK and the US – to describe the most pronounced

characteristic within The Firm in relation to error management, he replied ‘You know one of the things I’ve never experienced at The Firm is blaming.’ Taking these insights back to our participant observations, we noted that blaming within teams was actively prevented. Whenever a junior auditor started to engage in blaming, senior auditors immediately stepped in. This practice of stepping in usually took the form of statements like ‘this can happen to anybody’. The discouragement of blaming helped to create a more open climate, in which team members were more willing to articulate and reflect upon committed errors.

**‘Just call him’.** A further pronounced practice within audit teams is the practice to push issues around quickly within The Firm in order to address the issue most appropriately. A manager described this practice with the following example. Typically, there are two to three critical points within an audit. These points when identified by the junior auditors will be addressed to the senior auditor. If the problem cannot be solved by the senior auditor it is quickly escalated to the manager and the partner. If the issue can still not be properly addressed it will be pushed to specialists in the field. These can be other partners, managers, and other specialists. The other way around, junior auditors are always surprised when partners ask them what they think of a given circumstance. This happens particularly when talking about processes within the client firm. The notion of quickly pushing an issue to somebody who is most knowledgeable to solve the issues was also expressed by the manager who stated:

‘Whatever happens, there will be somebody who can solve it within The Firm.’

**‘Professional skepticism’.** Within The Firm auditors were considered to be ‘very skeptical’ in comparison to colleagues from other service lines. This was something auditors even prided themselves on. In a discussion with an audit partner she amused herself about how ‘consultants always believe all the figures they see. They really don’t question too much’. Also in interviews this skepticism was prominent. One of the HR professionals described how she was very nervous and double and triple checked her figures and arguments before she presented something to audit partners, while she was less concerned with partners from other service lines. She said ‘It is really hard to convince the auditors.’ In the daily practice of auditors this professional skepticism plays an important role and we found during our participant observation that junior auditors are actually actively trained to ‘exert professional skepticism’. The importance of professional skepticism is mainly trained through coaching on the job and is further developed through everyday experience by auditors. One

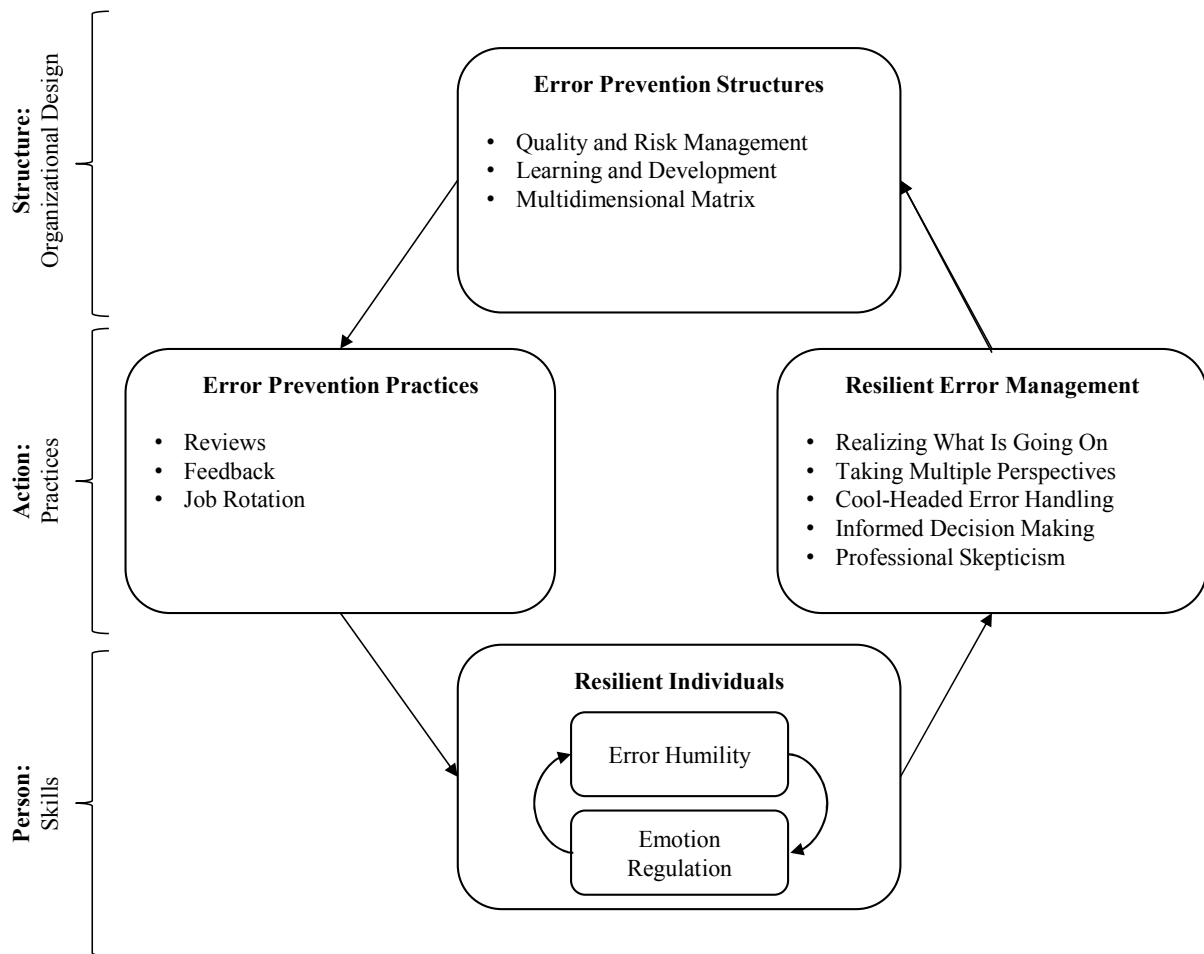
common practice well known to every auditor in The Firm is the following: A junior auditor is sent to the client to receive an explanation for a certain issue. After a while the junior auditor comes back to the auditor's room and reports what the client has told him or her. The senior auditor will point out contradictions in the explanation that the junior auditor presents, and sends him or her back to the client. This practice will be repeated until the senior auditor thinks that the junior auditor has 'properly understood' the issue. Besides this active coaching on the job, auditors develop deep rooted skepticism through their everyday experience. As auditors review the work of clients, they are constantly confronted with errors. This confrontation with errors in combination with clients that falsely state 'this time I am absolutely sure that the calculation is correct' has a significant effect on the development of 'professional skepticism'.

### **TOWARDS A SOCIO-COGNITIVE MODEL**

Our case study suggests a socio-cognitive model that is summarized in Figure 1. The underlying idea of this socio-cognitive model is that error management is a result of a self-reinforcing system, in which structures and systems, organizational practices, and individual skills interact and jointly constitute and reconstitute each other. In this section, we explain this model by showing how organizational *error prevention structures* and resulting *error prevention practices* shape *resilient individuals* who are the key to *resilient error management practices* in audit teams; and how the *resilient error management practices* that are practiced within the teams are again reflected in the organizational *error prevention structures* of accounting firms.



**FIGURE 2:**  
**A Socio-Cognitive Model of Error Management**



### From Error Prevention to Resilient Individuals

Our case study reveals how rigorous error prevention structures and systems form individuals with a high degree of resilience. Within The Firm we found rigorous *quality and risk management systems*, the *learning and development plans* and the *multidimensional matrix* structure. All three structures and systems are very present in the daily work of auditors through three dominant error prevention practices: *reviews*, *feedbacks* and *job rotations*. Within these structures and practices, our case reveals a continuous development of auditors as they progress through the ranks. This development has been described by auditors as to develop a ‘Tiefenentspanntheit’ (deep relaxation) in respect to occurring errors. We abstract this emotional development of auditors to the more general concept of *emotion regulation*. Like others, we define emotion regulation as ‘the use of self-regulatory processes to keep performance anxiety and other negative emotional reactions (e.g., worry) at bay

during task engagement' (Kanfer, Ackerman, & Heggestad, 1996: 186). Furthermore, we found that the emotional development of individual auditors was accompanied by an increasingly stronger 'awareness of their own fallibility' and 'accepting errors as a normal part of work' which we labeled *error humility*. We define *error humility* similarly to how others have described humility as an accurate sense of one's abilities and achievements, which includes the ability to acknowledge one's own imperfections (Owens & Hekman, 2012; Tangney, 2000) particularly in respect to errors. As both individual characteristics, emotional regulation and error humility, help the individuals to cope and 'bounce back' from stressful events (Rutter, 1985), we associate these characteristics as skills of *resilient individuals*.

The development of *resilient individuals* when confronted with errors through error prevention practices such as *work reviews*, *job rotation* and *feedback* is in line with previous research from other fields. Research in the field of resilience argues that resilience is a response to adverse events and stressors like errors (Connor & Davidson, 2003; Heimbeck, Frese, Sonnentag, & Keith, 2003; Rutter, 1985). This literature describes resilient individuals as people having personal qualities that enable them to thrive in the face of errors, involving the use of self-regulatory processes to keep negative emotional reactions at bay (Connor & Davidson, 2003; Keith & Frese, 2005; Rybowski et al., 1999). Also Rutter suggested that 'the promotion of resilience does not lie in an avoidance of stress, but rather in encountering stress at a time and in a way that allows self-confidence and social competence to increase through mastery and appropriate responsibility' (Rutter, 1985: 608). This notion is supported by finding that when individuals are confronted with errors they develop higher degrees of individual emotion regulation and metacognitive abilities (Keith & Frese, 2005). Particularly interesting in Keith and Frese's (2005) study is that the metacognitive ability which 'involves skills of planning and monitoring as well as evaluation of one's progress during task completion' is similar to *error humility* that we found in respect to the awareness of errors and preparedness for them to happen.

### **From Resilient Individuals to Error Prevention Structures**

Our case study demonstrates that *resilient individuals* within audit teams engage in five distinct *resilient error management practices* that enable the teams to discover and manage errors when they occur. Our participant observation revealed how leaders in audit teams constantly struggle to *realize what is going on* and how auditors engage in the practice of *taking multiple perspectives* and demonstrate a high degree of *professional skepticism* in comparison to other knowledge workers within The Firm. While these practices help the audit

teams to anticipate and detect errors early on, our case reveals that they managed the occurrence of errors with a *cool-headed error handling* approach, complemented by a practice that we called *informed decision making*. Furthermore, our case study suggests that these resilient error management practices are again reflected within the *organizational structures and systems*. In our case study we found that accounting firms have implemented a sophisticated *quality and risk management system* which enables them to be very attentive to operations and environmental risks to quality. Furthermore, The Firm heavily engages in *learning and development* of each employee standardizing professional skills and has developed into *multidimensional matrix* structure providing the organization with greater degrees of flexibility and multiple learning opportunities.

The insight that *resilient individuals* are the basis for *resilient error management practices* is in line with Affective Events Theory (Weiss & Cropanzano, 1996). Affective Events Theory describes the differential effects of positive and negative affect due to affective events like errors. Research in this field demonstrates that employees with negative affect due to errors ‘can be more effective than their positive affect colleagues in certain situations’ (Ashkanasy & Humphrey, 2011: 216). In this respect also, scholars have argued that ‘negative affect can lead to more vigilant monitoring of environmental events, and less susceptibility of persuasion’ (Ashkanasy & Humphrey, 2011: 216). This is also sometimes referred to as the sadder-but-wiser hypothesis (Staw & Barsade, 1993). These findings on higher levels of monitoring of environmental events, and less susceptibility of persuasion are similar to our observation of the evolving *error humility*. In turn, *error humility* of auditors seems to be at the heart of the error resilience practices that we have observed, foremost of the practices that we have labeled *realizing what’s going on*, *professional skepticism*, *informed decision making* and *taking multiple perspective*. Yet, *cool-headed decision making* seems to be more associated with *emotion regulation*.

Moreover, comparing our findings on error resilience practices with the findings in the field of high reliability organizations demonstrates their similarities. To understand how some organizations achieve high reliability, researchers turned their attention to organizations which are forced to consistently deliver highly reliable performance under challenging conditions (La Porte & Consolini, 1991; Weick & Sutcliffe, 2001). Examples of these organizations are: nuclear power plants (Carroll, 1998), aircraft carriers (Weick & Roberts, 1993), operating rooms in hospitals (Edmondson, 1999; Edmondson et al., 2001; Faraj & Yan, 2006) and firefighters (Weick, 1993). In an attempt to summarize the findings from these efforts, Weick and colleagues describe five practices which they label processes of

collective mindfulness (Weick et al., 2008). These processes of collective mindfulness correspond to a high degree to the resilient error management practices that we have found in our case study. Furthermore, scholars have claimed that these processes and resulting practices become manifested within organizational structures over time (Weick & Sutcliffe, 2001; Weick et al., 2008). These insights are in line with our observations that also the organizational structures and systems of The Firm are highly flexible and attentive, a phenomenon that has also been noted by scholars in the field of professional service firms (Greenwood et al., 2010; Greenwood et al., 2006).

### **Contribution to the Field of Error Management**

Our socio-cognitive model of error management suggests that extant views of error management as either error prevention or error resilience may inaccurately describe error management within organizations. On the one hand, the error prevention approach has argued that quality depends on a ‘lack of unwanted, unanticipated, and unexplainable variance in performance’ (Hollnagel, 1993: 51) which shows that the ‘notion of repeatability or reproducibility of actions or patterns of activity is fundamental to this understanding’ (Weick et al., 2008: 35). Within this thinking, flexible practices and procedures suggested by the camp of error resilience do not lead to quality. On the other hand, scholars in the field of error resilience have convincingly argued that in an increasingly more complex world ‘for a system to remain reliable, it must somehow handle unforeseen situations in ways that forestall unintended consequences’ (Weick et al., 2008: 35) or in other words ‘unvarying procedures can’t handle what they didn’t anticipate’ (Weick et al., 2008: 35). However, our case study shows that these two approaches do not contradict each other, but, on the contrary, interact with and entail each other.

On the surface, the idea that error prevention approaches and error resilience approaches are not contradictory but mutually entailing seems to contradict previous insights in both fields. However, our socio-cognitive model helps to resolve this mystery (Alvesson & Kärreman, 2007) by demonstrating the interaction of both approaches on multiple levels of analysis. With our socio-cognitive model, we show how error prevention structures and systems on the organizational level serve two functions. First, the error prevention structures and systems provide a safe environment for the individual to make mistakes without resulting in an organizational failure. Second, and this is what previous research has overlooked, the same error prevention structures confront individuals with their own errors. This confrontation with errors on the individual level shapes resilient individuals. In turn, our case

study suggests that individual resilience is the basis for resilient error management within teams, which eventually becomes manifest in the organizational structures and systems.

On the other hand, the idea that constant confrontation with errors on the individual level eventually leads to high degrees of resilient error management practices seems to contradict insights from high reliability organization. Researchers into high reliability organizations have stressed that failures are rare events to learn from in these organizations (Klein, Bigley, & Roberts, 1995; Weick et al., 2008). However, these insights can be integrated by differentiating between failures and errors. Keith and Frese (2010) differentiate between errors and failures by defining failures as consequences of errors. In their definition, failures are negative consequences of errors, whereas learning and innovation are positive ones. Therefore, the same error may lead to different outcomes, depending on the circumstances in which it occurs (Keith & Frese, 2010). Making this distinction helps us to understand the learning and the development of high reliability processes more clearly. While there are few large-scale organizational failures of high reliability organizations (Weick & Sutcliffe, 2001) and of accounting firms (Francis, 2004, 2011), auditors are confronted with small-scale errors to learn from on the individual level. At the same time, these small-scale errors occur in a safe environment due to a rigorous quality and risk management system designed to prevent these errors accumulating and eventually leading to organizational failure. Therefore, learning and individual development through errors is achieved, while organizational failures are rare.

Furthermore, scholars have suggested that error prevention approaches inhibit a resilient error management approach. Particularly, scholars have suggested that an error management culture (Van Dyck et al., 2005) and the team climate of psychological safety (Edmondson, 1999) may suffer from an error prevention approach because of fear of error reporting due to blaming and other negative consequences like guilt (Zhao & Olivera, 2006). In contrast, our case study demonstrates that error prevention structures and systems do not inhibit error reporting and blaming, but that error prevention structures and procedures are the breeding ground for an error management culture, as well as a climate of psychological safety. Our socio-cognitive model demonstrates that thanks to these error prevention practices, the individual auditors develop *error humility* and learn to cope with them through what we described as *emotion regulation*. These two characteristics on the individual level are reasons why other individuals are not blamed for making a mistake. The reasoning is straightforward: if you know that you could have made, or have made, the mistake yourself, then how can you blame others for e.g. making a false judgment? Thus the development on

the individual level through error prevention structures and procedures is the basis for the development of an error management culture and the climate of psychological safety. In sum, we argue that an error management culture does not evolve in defiance of rigorous error prevention structures and systems, but rather coevolves with the establishment of rigorous error prevention structures and systems.

In conclusion, our socio-cognitive model contributes to the field of error management by providing an integrated model that takes into account valuable insights from both the error prevention and the error resilience approaches, and synthesizes them into a more consistent whole (Locke, 2007).

### **Contribution to the Field of Audit Quality**

Our socio-cognitive model also has important implications for our understanding of audit quality. First, by demonstrating how error prevention and resilient error management interact within accounting firms, our socio-cognitive model provides a new approach of understanding audit quality on the micro level. Initial research on the micro level of audit quality production has examined the influence of organizational principles on auditors' behavior in relation to audit quality (Coram et al., 2008; Coram et al., 2004; Malone & Roberts, 1996; Sweeney & Pierce, 2004). This research demonstrates that auditors' behavior is heavily influenced by organizational systems. In particular, these studies highlighted that those organizational systems can lead to violations within accounting firms. However, this line of research overlooked the fact that the same organizational systems also serve an important role in securing audit quality by forming *resilient individuals*. And we have argued that resilient individuals in accounting firms are the basis for resilient error management practices, which are the basis for high quality audits. Therefore, our socio-cognitive model informs research on the micro level of audit quality by demonstrating how organizational structures, practices and individual skills interact in order to produce high levels of audit quality.

Second, research in the field of audit quality suggests that accounting firm size influences the quality of audits. This relationship has been found on the organizational level (Becker et al., 1998; DeAngelo, 1981b; Francis & Krishnan, 1999) and accounting firm office-size level (Choi et al., 2010). Previous findings suggest that the reasons for the link between audit-firm size and audit quality are economic incentives (DeAngelo, 1981b; Dye, 1993), differences in the audit program (Blokdiijk et al., 2006), and differences in social capital (Francis & Yu, 2009). However, these explanations have not investigated how audit

quality is actually produced within different sizes of accounting firms. The socio-cognitive model may shed new light on the discussion of the audit quality difference between Big vs non-Big accounting firms. Particularly, the model suggests that the functioning within accounting firms on multiple levels of analysis plays an important role in understanding audit quality. We believe that this functioning within accounting firms may provide further explanations for the differences in audit quality of Big vs. non-Big accounting firms.

Third, our socio-cognitive model of audit quality contributes to our understanding of the accounting firms' organizational competence to find breaches in the financial statements of clients. Previous research on audit quality has mostly concentrated on examining contextual incentives for independent reporting of audit results (e.g. Acemoglu & Gietzmann, 1997; Ashbaugh, LaFond, & Mayhew, 2003; Chung & Kallapur, 2003; DeAngelo, 1981a; DeFond et al., 1999; Lee & Gu, 1998; Magee & Tseng, 1990; Menon & Williams, 2004; Ye, Carson, & Simnett, 2011). However, few focused on the organizational competence that leads to varying degrees of audit quality. By demonstrating the complex interaction within accounting firms that enables them to produce high quality audits, our socio-cognitive model opens up a broad field for future research.

## **CONCLUSION**

On the basis of an in-depth case study of a Big 4 accounting firm, we study error management to gain a better understanding of audit quality on the micro level. The resulting socio-cognitive model explains error management as a self-reinforcing system, in which structures and systems, organizational practices, and individual skills interact and jointly constitute and reconstitute each other in the production of audit quality. In particular, our study shows how organizational error prevention practices shape resilient individuals who are the key to resilient error management practices in audit teams. Furthermore, resilient error management practices are reflected in the organizational structures and systems supporting error management in accounting firms. The socio-cognitive model informs both the field of error management and audit quality. The model informs literature on error management by pushing the general research agenda from either an error prevention approach or an error resilience approach towards an integrated view. Moreover, the socio-cognitive model informs the literature on audit quality by suggesting a micro level model of audit quality. As such, it provides a more complete understanding of how audit quality is produced in practice. We hope that by opening up the 'black box' of accounting firms, the socio-cognitive model opens

an avenue for future research that bridges the discourse on error management with the discourse on audit quality.



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**LEVERAGING ERROR TO IMPROVE PERFORMANCE:  
A MODEL OF INDIVIDUAL ERROR MANAGEMENT**

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### **ABSTRACT**

Despite extensive research on human error, our understanding of how individuals manage occurring errors remains limited. Our research addresses this gap in the literature by investigating individual error management in a two-phase mixed methods study. In the first phase, we explore individual error management in an in-depth field study involving 12 months of participant observation and 38 interviews. Our findings suggest that humility and self-efficacy are antecedents of error management and that error management is positively associated with learning and performance. In the second phase, we test the model of individual error management in a questionnaire study with 278 participants. The results of our structural equation modeling confirm the suggested relationships. The findings of this research contribute to the literature by highlighting the importance of understanding individual error management to understand human errors in the context of organizations more comprehensively.

**Key words:** Individual Error Management, Performance, Humility, Self-Efficacy

## INTRODUCTION

*'Man errs as long as he doth strive...'*

*J.W. von Goethe (1749-1832)*

...and let us be frank, *we all hate that!* We hate making errors because we try to hold up a positive self-concept which is marred by our own errors (e.g. Festinger, 1962). Furthermore, errors may have serious negative consequences for individuals, as well as for society. These negative consequences range from time loss, to faulty decisions, to extreme cases in which errors lead to disasters, such as car crashes, train accidents, or even nuclear catastrophes. Nevertheless, almost all cultures seem to have found something good about errors, as indicated by proverbs that have been passed on through generations. For example, a Chinese proverb states, 'mistakes and failures are the milestones on your way to success.' A Spanish proverb explains that 'he is always right who suspects that he makes mistakes,' and Nietzsche concludes that 'our shortcomings are our best teachers.' In the same vein, we raise our children by telling them heroic tales in which a hero initially fails but later recovers, learns from his failure, and rises to new heights. Both the proverbs and heroic tales suggest that errors may not be bad per se but that the consequences of errors are strongly influenced by the way in which we cope with them.

Our study investigates how individuals cope with errors - i.e., individual error management (Rybowiak, Garst, Frese, & Batinic, 1999) - closing an important gap in the literature. Previous research on human errors has mainly focused on error prevention by taking a person approach or a system approach. The person approach attempts to prevent human errors by understanding countermeasures, such as written procedures, trainings, and disciplinary measures (Reason, 1990a). The system approach attempts to prevent human errors by understanding error-producing working conditions, such as faulty processes, system defenses, and organizational culture (Reason, 1990a). In contrast, research on the management of occurring errors is still scarce. This relative lack of literature is surprising because initial studies on the organizational- (Van Dyck, Frese, Baer, & Sonnentag, 2005) and team-level (Edmondson, 1999) suggest that error management is an effective strategy for approaching errors (Edmondson, 1996; Van Dyck et al., 2005). Furthermore, research suggests that error management may improve individual learning and performance (Hofmann

& Frese, 2011a; Keith & Frese, 2005, 2008). However, our understanding of error management on the individual level remains limited (Zhao, 2011).

Our research contributes to the literature by suggesting and testing a model of individual error management. To examine individual error management, we use a two-phase mixed methods research design. In the first phase, we use an inductive approach to understanding the antecedents of individual error management and their implications for learning and performance. Based on data collected during 12 months of participant observation and 38 interviews, we propose a model of individual error management. The model suggests that humility and self-efficacy are antecedents of error management and that a relationship exists between error management and performance that is mediated by learning. In the second phase of our study, we test the proposed model of individual error management in a questionnaire study with 278 participants. The results of our structural equation modeling (SEM) confirm the proposed relationships.

### **THEORETICAL ORIENTATION**

Errors are defined as potentially avoidable, unintended deviations from plans or goals (Reason, 1990a; Van Dyck et al., 2005; Zhao & Olivera, 2006). To understand errors and their consequences in organizations mainly three approaches have been used: the person approach, the system approach, and the error management approach. In the following, we briefly describe these three approaches and outline the gap in the literature that motivated our research.

***Person approach.*** The person approach has a widespread tradition in error research (Reason, 2000). The person approach aims to understand error prevention on the sharp end of operations. This approach has often focused on the direct interaction of humans and machines and aimed to understand how errors in that interaction can be prevented by designing direct countermeasures (Reason, 1990a; Reason, 1995). Examples of such countermeasures are written procedures, trainings, and poster campaigns (Reason, 2000). The individual has an important role in this approach; however, the view of the individual in this approach is rather negative. The individual is the cause of errors, which means that errors mainly arise from flaws in human nature, such as bounded rationality (e.g. Simon, 1959; Simon, 1991), biases, and heuristics (e.g. Kahneman, Slovic, & Tversky, 1982; Kahneman & Tversky, 1979; Tversky & Kahneman, 1974). In other words, the person approach views errors mainly to result from ‘unwanted variability in human behavior’ (Reason, 1990a). Concerning the consequences of errors, this approach takes a one-sided view by equating errors with their

negative consequences, such as stress, time loss, and accidents. As a result, the aim is to prevent errors in order to prevent the negative consequences of errors (Hofmann & Frese, 2011a). Nevertheless, an implicit assumption of the person approach is that error-free performance is possible depending on the effectiveness of direct error prevention countermeasures (Goodman et al., 2011).

***System approach.*** The system approach is the second dominant research approach to errors. The system approach moves away from a pure focus on the individual and instead highlights error-producing working conditions (Reason, 1990b, 1990a; Reason, 1995), such as a high work load, time pressure, and fatigue (Reason, 1995). The individual has two important roles in the system approach (Reason, 1995), first, as the party who is directly influenced by the error-producing working conditions and, second, as the decision maker who is responsible for creating these working conditions. Nevertheless, the system approach also views the individual as a fallible element and thus suggests creating system defenses to prevent human errors (Reason, 1990b, 1990a; Reason, 1995). Similar to the person approach, the system approach suggests that errors mainly have negative consequences and that errors can be prevented by improving working conditions and system defenses.

***Error management approach.*** The error management approach is a nascent but increasingly popular approach. This approach focuses on managing occurring errors rather than trying to prevent them (Frese & Zapf, 1994; Hofmann & Frese, 2011b; Van Dyck et al., 2005). A main assumption of the error management approach is that errors can never be prevented completely. Therefore, this approach suggests that errors should be managed in order to decrease negative consequences (e.g., stress, time loss, failure) and increase positive consequences (e.g., learning, innovation, vigilance) (Hofmann & Frese, 2011a). The individual has a very active role in the error management approach. In particular, the error management approach suggests that an active individual orientation toward error is important for managing errors effectively (Rybowiak et al., 1999).

Individual error management has been conceptualized by Rybowiak, Garst, Frese and Baltinic (1999), who define individual error management as an individual ability to anticipate errors and cope with occurring ones (Rybowiak et al., 1999). They suggest that there are four facets of individual error management: error anticipation, error competence, error learning, and error risk taking (Rybowiak et al., 1999). Error anticipation is an active orientation toward errors that entails the ability to foresee potential errors. Error competence is the ability to quickly recover from errors in order to quickly handle them. Error learning is the ability to adopt future action based on an error so that future actions are optimized. Error risk taking is

defined as a general flexibility and openness toward errors, which also implies that minor errors are acceptable in order to reach higher goals (Rybowiak et al., 1999).

***Critique of existing approaches.*** Despite the contributions of all three approaches, our understanding of human errors remains incomplete. The majority of studies on human errors focus on error prevention. Although the error prevention approaches highlight the importance of the individual, they have neglected to provide an understanding of how to manage occurring errors. On the other hand, the error management approach highlights the importance of managing occurring errors. However, despite initial studies on the organizational (Van Dyck et al., 2005) and team level (Edmondson, 1999), our understanding of individual error management remains limited. This relative neglect of the individual level is surprising for two reasons. First, the error management approach highlights the importance of an active orientation for the individual in order to understand errors and their consequences in organizations (Frese & Zapf, 1994; Hofmann & Frese, 2011a). Second, previous research suggests that error management may be important in understanding individual learning and performance (Keith & Frese, 2008; Klein et al., 2007; Zhao, 2011).

Our research project investigates individual error management by attempting to answer the following two research questions: First, what are the individual differences in error management? Second, is individual error management related to learning and performance, as suggested by the error management approach?

## **RESEARCH DESIGN**

We use a two-phase mixed methods approach to study individual error management. In the first phase, we use an inductive qualitative approach to develop a model of individual error management (Edmondson & McManus, 2007; Eisenhardt, 1989; Jick, 1979; Reason, 1990a). In the second phase, we use a deductive quantitative approach to test the model of individual error management (Edmondson & McManus, 2007; Reason, 1990a). The advantage of our two-phase mixed methods design is that it combines the strengths of both research approaches and helps in triangulating the findings with different data sources and methods (Fine & Elsbach, 2000; Lee, 1991). This triangulation approach has been suggested to be particularly useful for gaining a deep understanding of a specific phenomenon (Creswell, 2003; Edmondson & McManus, 2007; Jick, 1979).

## **Research Site**

We conducted our study in a large international accounting firm. We chose the context of an accounting firm for three reasons. First, previous research suggests that errors frequently occur in accounting firms due to the nature of the work. Accounting firms audit the financial statements of their clients. An audit involves substantial coordination because it usually involves multiple teams that are in multiple locations and that have multiple cultural backgrounds. Within each team, the individuals are faced with high workloads and substantial time pressure. Usually, new things must be learned about the client, the accounting framework, and the technology that the client uses. Furthermore, auditors generally must quickly switch between tasks in order to respond to questions within the team and requests from the client. All of these factors have been suggested to increase the likelihood of errors (Hofmann & Frese, 2011a; Keith & Frese, 2010; Zapf, Brodbeck, Frese, Peters, & Prümper, 1992).

Second, errors can be clearly detected in accounting firms. Accounting firms operate within a rigid regulatory environment, which is highly attentive to errors (Gold, Gronewold, & Salterio, in press). As a result, there are clear procedures on how to perform audit tasks. Any deviation from these procedures can be identified as an error. Furthermore, identified errors can be attributed to the individual who is accountable for a certain task. This clear attribution is assured by the requirement that every auditor sign the work that he or she has done. Through multiple review processes, a high degree of error detection is assured (Owhoso, Messier, & Lynch, 2002).

Third, researching individual error management in an accounting setting offers practical benefits. Most audit team members work within one room and audit teams typically consist of two to ten individuals. This setting allows a constant comparison of individual differences in their error management, which is believed to strengthen inferences about a phenomenon (Platt, 1964). Furthermore, the nature of the work of auditors implies the identification of errors. Thus, auditing is an interesting setting for observing how client employees deal with errors that are pointed out to them. In sum, the error-prone work environment, the relatively clear error detection, and various practical benefits make the auditing context an interesting setting for studying individual error management.

## **STUDY 1: EXPLORING INDIVIDUAL ERROR MANAGEMENT**

In the first phase, we used an inductive qualitative approach to explore individual differences in error management and their implications for performance. We chose this



inductive qualitative approach for three main reasons. First, qualitative approaches have widely been suggested for exploring phenomena that are not well understood (Edmondson & McManus, 2007; Lee, 1991). As error management is still a nascent line of research, a qualitative approach seemed appropriate. Second, a qualitative approach has the advantage that ‘it offers a much broader perspective on the mental landscape than can be obtained from the [, for example, ] necessarily focused laboratory studies’ (Reason, 1990a: 14). This broad perspective was particularly important for exploring antecedents of individual error management. Third, a qualitative approach helped us gain familiarity with the peculiarities of the auditing industry and the language that is used within this industry. This insider knowledge was important for choosing measures in our quantitative phase, which are meaningful for auditors (Edmondson, 1999; Lee, 1991).

### **Data Collection**

We used mainly two data collection strategies: participant observation and open-ended interviews. We were able to engage in these two data collection strategies because one of the investigators worked for three years, part-time, in an international accounting firm. Through the combination of these two data collection strategies, we tried to triangulate our findings with different qualitative data sources.

***Participant observation.*** The primary data collection strategy involved participant observation. Participant observation allowed us to gain an intimate understanding of participants’ individual error management in their day-to-day work. Furthermore, it allowed us to directly compare individual reactions to errors against each other. This direct comparison of ‘mini-cases’ has been suggested to be particularly fruitful for creating theoretical propositions of related constructs (Eisenhardt, 1989). Moreover, working within teams resulted in a trusting relationship with the auditors (Yin, 2003). This mutual trust proved to be essential for openly discussing errors and error management. In total, we actively worked with and observed colleagues in nine audit teams. The number of team members on the different teams varied from two to ten auditors of the core audit engagement team. The total time spent in audit teams spanned approximately 12 months.

***Interviews.*** Open-ended interviews were a second source of data. Following theoretical sampling (Glaser & Strauss, 1967), we built in different instances to find variations in the data in order to explain individual differences in error management. We selected instances along various dimensions, such as the interviewees’ rank, team, office, nationality, and provided service. We conducted open-ended interviews with 31 auditors across all

hierarchies from 12 offices in 10 countries. Additionally, we interviewed seven management consultants from the accounting firm, which allowed us to compare the auditors' answers to those of another group of knowledge workers (Alvesson, 2001). The initial interviews were conducted with the help of semi-structured question guidelines. The questions were taken from questionnaires that have previously been used for studying error orientation (Rybowiak et al., 1999). After the first 10 to 15 interviews, we reached a point of theoretical saturation for most themes indicated by the questionnaire. Thus, we began further exploring themes that had emerged during the participant observation and interviews. We started every interview with a broad question. This technique, which was proposed and used by Edmondson (2003), helped new themes emerge before we limited the informants' responses to specific questions (Edmondson, 2003). All interviews were recorded and fully transcribed to facilitate the data analysis.

### **Data Analysis**

The analysis of our qualitative data followed an inductive open-ended analysis (Locke, 2007). Starting with the data collection, the analysis followed an iterative process of moving back and forth between the data and emerging relationships. This continuous comparison occurred concurrently with the data collection and helped carve out dominant concepts. These concepts formed more abstract constructs, which were the building blocks of the emerging propositions (Isabella, 1990; Strauss & Cobin, 1998; Suddaby, 2006). This iterative process was assisted by the qualitative data analysis software Atlas.ti 6.0.

Despite its iterative nature, the data analysis process can roughly be described as follows. In a first step, interviews were open coded on the four facets of error management: error anticipation, error competence, error learning, and error risk taking. Subsequently, we reduced the list of themes and grouped passages from different interviews and observations that referred to the same theme. This initial step revealed that individuals have very different approaches toward errors, as noted by one auditor: 'It is a person-by-person thing. I have worked with some staff who would immediately admit that something is wrong and say 'look, this has happened,' and there are people who try to hide it.' This step revealed that two antecedents were strongly associated with individual error management. Thus, we explored them further in a second step.

In a second step, we refined our analysis of the antecedents of individual error management. For the first antecedent, three characteristics stood out. Our data were scattered with expressions such as, 'I have made errors all the time,' 'I'm sure I've always been

committing errors,’ and ‘everybody makes mistakes.’ We extrapolated these acknowledgements of personal imperfections to the more abstract concept of *awareness of one’s fallibility*. Despite having a strong *awareness of one’s fallibility*, our research suggests that these auditors did not have low self-esteem and that they demonstrated a rather *adequate self-perspective*. Additionally, these auditors showed a strong focus on learning, as noted by one interviewee: ‘it is all about learning more from them [errors] and at least ensuring that you are not making the same errors the next time.’ We extrapolated the cues about a strong learning focus to the more general notion of *openness to learning*. Taking all three characteristics - *awareness of one’s fallibility*, *adequate self-perspective*, and *openness to learning* - as a basis, we reviewed the literature and found them to be core characteristics of the concept of *humility*.

A second antecedent emerged from the data. Some auditors seemed to have a strong belief in their own abilities to overcome the problems associated with errors, with statements such as, ‘I am a certified public auditor. Whatever will come, I will be able to deal with it.’ We assigned this strong belief in their own competence in dealing with errors to the more abstract concept of *belief in one’s ability*. Related to this belief, they also demonstrated a more positive view of errors by framing them as potential challenges that they could learn from. We took these cues and abstracted them to the more general concept of having a *positive view of outcomes of errors*. At the same time, we found that these individuals had a high degree of emotional self-regulation when they faced errors. One auditor stated that ‘even if it [the error] is really stupid, you have to try to remain calm.’ We aggregated this effort to stay calm to the more abstract concept of *emotion regulation*. Taking these three characteristics - *belief in one’s ability*, *positive view of outcomes of errors*, and *emotion regulation* - as a basis, we reviewed the literature and found that these characteristics are associated with the more general concept of *self-efficacy*.

In a third step, we focused on the importance of error management for individual work performance. In particular, our participant observation over 12 months demonstrated that error management is essential for auditors. We found that error anticipation is crucial in auditing because it ensures a ‘smooth work flow.’ Error competence was necessary for quickly acting and reacting to errors. Error learning was even an essential part of the learning and development of auditors. Moreover, error risk taking was crucial for giving auditors the ability to perform effective audits. During the phase in which we focused on the relevance of error management for auditors, we found that auditors with better error management had

‘steeper learning curves.’ These auditors seemed to learn more quickly, which allowed them to perform better on audit engagements over the long term.

In a fourth step, we further aggregated our understanding of the antecedents of individual error management and its implications for learning and performance in a theoretical model. To ensure the reliability and credibility of our theoretical model, we used four main procedures. First, we discussed the main constructs within our research group and asked the discussion partners to ‘rip our findings apart.’ Multiple rounds of questioning resulted in an increasingly robust model. Second, we triangulated the main concepts and their relationships with theoretical and empirical findings from the literature. This theoretical triangulation further refined our understanding of the relationships. Third, we presented our model to leading researchers in the field of human error and asked them to critically examine its plausibility. Their comments were particularly helpful for improving our understanding of the antecedents of error management. Fourth, we presented our case study to auditors of different ranks in the accounting firms to validate our understanding of individual error management within our case study.

### **The Case Study**

*‘He is always right who suspects that he makes mistakes’.* Error anticipation - the ability to foresee potential upcoming errors - proved to be a highly important ability in the auditing environment. Error anticipation is important in auditing because it ensures a smooth work flow. This smooth work flow is assured by actively planning ahead to work around potential errors. We found that an active orientation toward potential errors resulted in less work that was not associated directly with performing an audit task. Thus, auditors with higher error anticipation worked more effectively. Additionally, auditors’ error anticipation was important in foreseeing an accumulation of errors, which could result in a project’s failure. Failure due to low error anticipation was described in one interview in which we asked a partner to describe a failed project: ‘Yes, I just had an extreme case of failure; in this case, a manager really screwed up. He absolutely did not recognize the complexity of the task, and he completely ignored a huge number of red lights.’ In other words, the lack of error anticipation played a major role in the project’s failure. In fact, managers and partners did not seem to fear anything more than team leaders with a lack of error anticipation, because they threatened the success of the audit engagement.

We found that error anticipation was higher for auditors with a higher awareness of their own fallibility and a more accurate self-perspective. Auditors with a high awareness of

their own fallibility expected to make errors themselves and thus foresaw errors in their own work. As a result, these auditors engaged in, for example, substantial self-review before they handed in working papers for further review. Auditors with a more accurate self-perspective also seemed to be more realistic about their time plans and thus foresaw potential errors associated with those time plans. Furthermore, we found that a higher awareness of one's fallibility led to a higher anticipation of errors by others. For example, we found that team leaders with a greater awareness of their own fallibility expected junior auditors to make errors and thus engaged in what they called 'preventive reviewing,' which was dubbed as such because they constantly checked the progress of the junior auditors by asking them casual questions. This error anticipation practice enabled the team leaders to quickly identify potential errors in the work of junior auditors and thus 'bring them back on track.'

*'An error no wider than a hair will lead a hundred miles away from the goal'*. Our case study revealed that error competence - quick recovery from errors - is essential in the error-prone environment of auditing. In auditing, we found that quick recovery was crucial for quickly and calmly handling occurring errors. We found that quick error recovery was particularly important for team leaders. Team leaders with high error competence quickly recovered from errors and began calmly restructuring the team in order to handle the errors. Leaders with lower error competence engaged in more rushed and imprudent actions, which mostly resulted in less effective auditing over time. Nevertheless, quick error recovery was also important for younger auditors. We found that younger auditors with lower error competence seemed to 'freeze' or 'engage in blaming the client' when confronted with errors.

In our research, we found that auditors with higher error competence were either more aware of their own fallibility or very successful in regulating their emotions. For example, when an error was pointed out during working paper reviews, auditors with higher awareness of their own fallibility remained calm. These auditors seemed to have the ability to accept that 'errors are a normal part of auditing,' and thus, errors did not greatly affect them. Accordingly, these auditors were able to quickly recovery from the emotional impact of errors and ultimately solve errors that were brought to their attention. Moreover, auditors who were very successful in down-regulating their emotions also recovered quickly from errors. Such auditors remarked that 'it just does not help to get all crazy. You have to try to keep calm' and 'of course I know this sudden adrenaline shock, but I do not want to show it.' As a result of this active emotional regulation, these auditors recovered quickly and were thus able to quickly shift into error-handling mode.

***‘Our shortcomings are our best teachers’***. Our case study revealed that error learning - the ability to adopt future action so that future actions are optimized - is a cornerstone of the auditors’ learning and development. Error learning or gaining experience on the job was one of the pillars of the ‘learning experience,’ which consisted of ‘learning off the job’ by taking part in classroom teaching, ‘learning near the job’ by actively teaching others, and ‘learning on the job.’ In relation to learning on the job, auditors were actively advised to determine ‘what works and what does *not* work for them.’ Furthermore, the organizational design provided challenging working conditions through frequent job rotations and allowed auditors to work within new teams and with new clients. These factors inevitably resulted in an error-prone and ‘challenging’ work environment, which was described as a main contributor to the ‘steep learning curve’ of auditors.

However, not everybody learned equally from errors. Our case study revealed that error learning was higher for auditors who were either more open to learning or who had a more positive view regarding the outcome of errors and a stronger belief in their own abilities. First, our participant observation suggested that individuals with higher error learning showed a greater openness to learning in general. The importance of openness to learning became apparent in feedback talks with junior auditors. Junior auditors who were more open to learning were interested in errors which were pointed out to them and asked how to improve in this respect. In some cases, we even observed that some junior auditors took night classes to make up for their shortcomings. Auditors who were less open to learning blamed others or the circumstances that lead to their errors or weaknesses. Second, we found that auditors with high error learning held a more positive view of potential outcomes of errors and had a stronger belief in their own abilities. For example, we observed two reactions in situations in which a junior auditor pointed out an error in the general audit strategy to the team leader. If the auditor had a high belief in his own ability and expected to learn something from the error, the team leader engaged in a discussion of how to improve the audit strategy. When the team leader did not have a positive view of potential outcomes and a strong belief in his or her ability, he or she attempted to ignore the issue. For example, team leaders responded with answers such as, ‘we have always done it like this, so just do it like this again’ or ‘we really do not have the time to question everything.’ As a result, these team leaders did not alter their practices.

***‘Mistakes and failures are the milestones on your way to successes’***. Our inquiry highlighted that error risk taking - an openness toward errors, which also implies that minor errors are acceptable in order to reach higher goals - is an important ability for auditors. Error

risk taking was particularly present during our participant observation in two situations: ‘passing further work’ and admitting one’s own knowledge gaps. The practice of ‘passing further work’ involves auditing less risky accounts in less detail in order to spend the most time on the most crucial issues and thus improve the efficiency of an audit. Thus, an auditor may risk making an error in single accounts in order to achieve a higher-order goal. Another example is a situation in which auditors must admit to their own gaps in knowledge. In such a situation, an auditor must take the interpersonal risk of admitting that they do not know something in order to quickly finish their audit procedures. We found that junior auditors in particular struggled with taking the risk of showing that they lacked some knowledge. One auditor noted that ‘I had to get used to admitting that I do not know something because, after all, the team leader rates your performance, and I do not want to leave the impression that I have no clue.’ Nevertheless, taking the risk of being considered unknowledgeable is crucial to increasing the efficiency of one’s own work. As a result, both situations provided us with rich insights into individual differences in error risk taking.

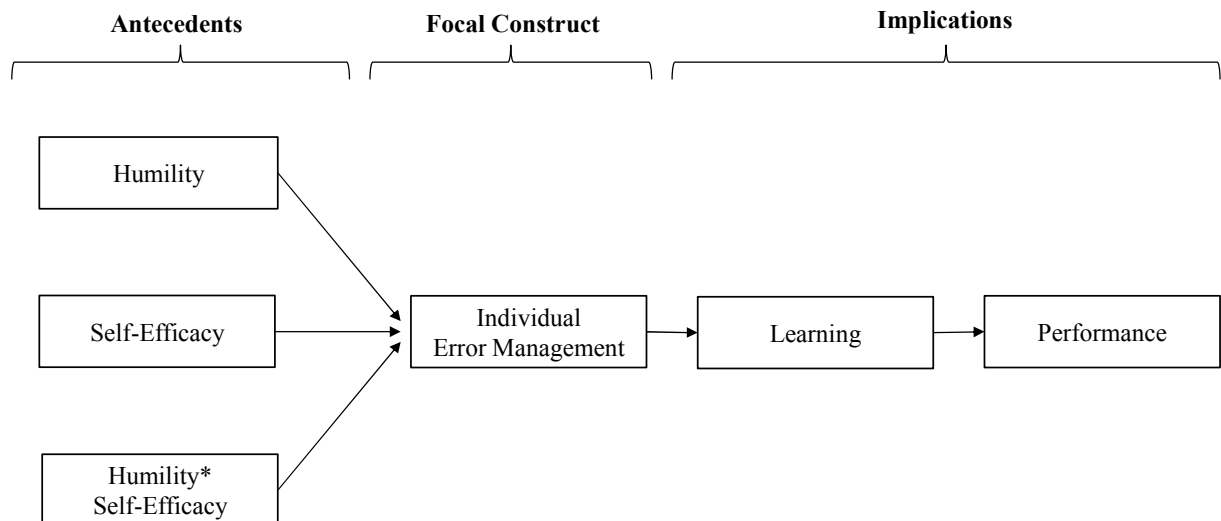
We found that the main difference in error risk taking resulted from the auditors’ belief in their own competence or the adequacy of their self-perspective. Auditors with a greater belief in their own abilities were not so much threatened by the risk of a potential error by ‘passing further work.’ They believed that they had the competence to determine when it was appropriate to ‘pass further work’ and thus were more likely to risk making errors. Similarly, auditors with a greater belief in their own competence did not struggle with admitting that they did not know something. They seemed more secure in their overall competence and were thus able to admit that they did not know something. The adequacy of self-perspective was also important for error risk taking. For example, individuals with a more adequate self-perspective were less troubled by admitting that they did not know something. They simply knew that they could not know everything and thus were not very troubled by admitting their knowledge gaps. Additionally, their adequacy of self-perspective helped them identify the situations where they should and should not ‘pass further work.’

### **Towards a Model of Individual Error Management**

On the basis of our case study, we propose a model of individual error management, which is summarized in Figure 1. The model incorporates two main antecedents of individual error management: humility and self-efficacy. Additionally, our case study provides further empirical evidence for the association of error management with learning and performance on the individual level. In this section, we explain this model, showing how humility and self-

efficacy are related to error management and how error management is related to learning and performance.

**FIGURE 3:**  
**Proposed Model of Individual Error Management**



**Humility.** In our case study, we found that individuals with higher error management also demonstrated a greater degree of an *awareness of one's fallibility*, *adequacy of self-perspective*, and *openness to learning*. We found that these characteristics are core characteristics of *humility* in the literature. Humility refers to the ability to acknowledge one's mistakes, imperfections, gaps in knowledge, and limitations and requires an accurate assessment of one's abilities and achievement (excluding self-esteem and self-depreciation) as well as openness to new ideas (Owens & Hekman, 2012; Tangney, 2000).

Our findings suggest that humility is positively associated with error management because it is related to error anticipation, error competence, error learning, and error risk taking. We found that humility leads to higher error anticipation because one's own errors, as well as errors by others, are expected. Therefore, more humble auditors anticipate errors to a higher degree. Our findings also suggest that humility is positively associated with error competence. We found that auditors with higher humility were less affected emotionally by errors because they expected to make errors. Therefore, higher humility helped auditors recover from errors more quickly. People with higher humility are also open to learning and



new ideas. Our participant observation suggests that this openness to learning increases auditors' ability to alter their skills and practices after an error has occurred. Therefore, our case study suggests that humility is related to higher error learning. Furthermore, more humble auditors showed higher error risk taking, for example, by admitting to their knowledge gaps. Because more humble auditors can acknowledge their own imperfections, they are more likely to risk making errors. Based on these findings, we expect that humility is positively related to error management.

Therefore, we propose the following hypothesis:

*Hypothesis 1. Humility is positively associated with error management.*

***Self-efficacy.*** Our case study also revealed that individuals with higher error management had a greater *belief in one's ability*, a more *positive view of outcomes of errors*, and a greater degree of active *emotion regulation*. We found that these characteristics are associated with a greater degree of *self-efficacy* in the literature. Self-efficacy is defined as 'the belief in one's competence to cope with a broad range of stressful or challenging demands' (Luszczynska, Scholz, & Schwarzer, 2005: 439). Research shows that self-efficacy is related to persistence in pursuing goals, more positive outcome expectations, and higher degrees of self-regulation for overriding impulses in order to achieve higher goals (Luszczynska et al., 2005).

Our case study suggests that self-efficacy is positively related to error competence, error learning, and error risk taking. Our findings suggest that self-efficacy is related to error competence because emotional regulation is required when errors arise. Therefore, our findings suggest that self-efficacy is important for quickly recover from errors. Our findings also suggest that individuals with higher self-efficacy perceive errors to be more challenges to learn from rather than threats. We find that perceiving errors as challenges increases individuals' error learning because individuals can use errors as a chance to alter their practices. Additionally, our findings indicate that self-efficacy is positively related to error risk taking because a greater belief in one's competence may increase the acceptance of minor errors as a means of reaching higher-order goals. Taking these findings on the importance of self-efficacy and the facets of error management together, we expect that self-efficacy has a positive effect on individual error management.

Therefore, we propose the following hypothesis:

*Hypothesis 2. Self-efficacy is positively associated with error management.*

Although our findings suggest that humility and self-efficacy are both positively related to error management, our case study suggests that these two effects are compensatory. The main reason for this finding is that humility and self-efficacy lead to higher degrees of error management for different reasons. For example, our case study revealed that humility leads to higher error competence because individuals expect that errors will occur and thus can recover from errors more quickly. In contrast, we found that self-efficacy leads to quick error recovery because individuals possess the ability to quickly regulate the negative emotions that result from making errors. Given the different reasons that humility and self-efficacy lead to higher error management, we suggest that humility and self-efficacy have a compensatory effect on error management. More specifically, we expect that humility has a compensatory effect on individuals with lower self-efficacy.

Therefore, we propose the following hypothesis:

*Hypothesis 3. Humility moderates the relationship between self-efficacy and error management such that the relationship between self-efficacy and error management is stronger positive for individuals with high levels of humility than for individuals with low levels of humility.*

**Error management.** Our case study suggests that error management is essential for performing well as an auditor. In our case study, we found that error anticipation is important for auditors because it increases error anticipation practices, such as preventive reviewing. Such preventive practices mainly assure that multiple audit tasks can be accomplished efficiently. Error competence is essential to take immediate and appropriate actions after an error occurs, and thus error competence increases individual performance. An important aspect of the development of auditors is ‘learning on the job.’ Therefore, we suggest that individuals’ long-term performance increases with higher error learning. Moreover, our case study revealed that error risk taking is an important aspect of auditing, as shown by the relevance of ‘passing further work’ and admitting gaps in one’s knowledge. Taken together, these findings suggest that individual error management is associated with performance.

Therefore, we propose the following hypothesis:

*Hypothesis 4a. Error management is positively associated with performance.*

Additionally, our case study revealed that error management was particularly important for increased performance because individuals with higher error management demonstrated higher overall learning on the job. Individual learning is defined as a process by

which skills, initially acquired via cognitive processing, become automated or implicit (Maxwell, Masters, Kerr, & Weedon, 2001). Our case study suggests that individuals with higher error management have a higher capacity for learning because they develop skills and integrate them into their everyday work based on the errors that they make. We suggest that quickly acquiring new skills is particularly important in auditing, which is characterized by rapid changes between tasks, the need to acquire knowledge about new things, complex technology, varying clients, and high coordination demands. Taking the importance of error management in learning and performance together, we expect an indirect effect of error management on performance via learning.

Therefore, we propose the following hypothesis:

*Hypothesis 4b. Learning mediates the effect of error management on performance in that (a) error management leads to higher learning and (b) learning positively affects performance.*

## **STUDY 2: TESTING THE MODEL OF INDIVIDUAL ERROR MANAGEMENT**

In the second phase of our research project, we tested the model of individual error management in a questionnaire study. Questionnaire studies are suggested to increase the generalizability of findings and allow for the collection of more objective data in order to test hypothesized relationships (Edmondson & McManus, 2007; Lee, 1991). Additionally, we tried to complete what has been called ‘full-cycle’ research by complementing our qualitative theory building approach in Study 1 with a theory testing approach in Study 2 (Cialdini, 1980; Fine & Elsbach, 2000).

### **Method**

**Sample and procedure.** We distributed a questionnaire at an international training session conducted in the same international accounting firm that was used in Study 1. The study included 278 participants, equaling a response rate of 46%. Distributing the questionnaire at a training session allowed us to draw a sample from a rather homogenous group of individuals concerning age, firm tenure, intelligence, and educational level. The participants were from several European cities, with the largest proportions from Paris ( $n = 32$ ), London ( $n = 23$ ), and Stockholm ( $n = 16$ ). All the participants used English-language questionnaires. The mean age of the respondents was  $M = 26.69$  years ( $SD = 2.17$ ). The sample consisted of 147 males and 116 females, and 15 respondents did not indicate their

gender. All constructs except for performance were measured on a 7-point Likert scale. Performance was measured on a 15-point scale, as described below.

## **Measures**

***Self-efficacy.*** We assessed self-efficacy on a six-item scale developed by Schwarzer and Jerusalem (Schwarzer & Jerusalem, 1995). Sample items include ‘I can always manage to solve difficult problems if I try hard enough,’ ‘If someone opposes me, I can find the means and ways to get what I want,’ and ‘It is easy for me to stick to my aims and accomplish my goals.’ Cronbach’s alpha for the self-efficacy scale was  $\alpha = .83$ .

***Humility.*** We measured humility using five items suggested by Owens, Johnson, Mitchell (2013). Sample items included ‘I admit when I don’t know how to do something,’ ‘I seek to objectively appraise my weaknesses and limitations,’ and ‘I admit it when I make mistakes.’ Cronbach’s alpha for the humility scale was  $\alpha = .85$ .

***Error management.*** Error management was established as a second-order latent factor of first-order latent factor loadings from error anticipation, error competence, error learning, and error risk taking. All items for these first-order latent factors were drawn from Rybowskiak et al. (1999). *Error anticipation* was measured with five items, and Cronbach’s alpha was  $\alpha = .73$ . *Error learning* was measured with three items, and Cronbach’s alpha was  $\alpha = .85$ . *Error competence* was measured with four items, and Cronbach’s alpha was  $\alpha = .71$ . *Error risk taking* was measured with four items, and Cronbach’s alpha was  $\alpha = .74$ .

***Learning.*** Individual learning was measured using a scale from Taris et al. (2003). Sample items included ‘At work, I learn new things,’ ‘I am constantly looking for new challenges in my job,’ and ‘I spend much energy in keeping up with recent developments.’ The scale was found to be reliable, and Cronbach’s alpha was  $\alpha = .78$ .

***Performance.*** We used three items from the company’s performance rating system to assess individual performance. In the survey, we asked the participants, ‘What was your overall rating last year,’ ‘What was your last job rating,’ and ‘What was your highest job rating last year.’ We used these three items to obtain a comprehensive measure of the performance (Cronbach’s  $\alpha = .85$ ). The first item regarding the overall rating is an aggregated performance indicator, which is derived by evaluating all the ratings within one year for an auditor. Our qualitative study showed that everybody within the accounting firm was well aware of this rating, because it is the basis for bonus payments, promotions, and future compensation. The second item refers to the most recent rating an individual has received. Our case study showed that recently received ratings are well remembered, and thus, asking

auditors to indicate their most recently received rating seemed appropriate for assessing performance. The third question refers to the highest rating of an individual. We chose this question to assess the performance potential of individuals. The age and gender of participants were controlled for in all analyses, as these were found to relate to performance.

### **Data Analysis**

We used structural equation modeling (SEM; Bollen, 1989) to assess the fit of the data with our hypothesized model. To control for common method variance, we employed latent variable SEM with AMOS (Arbuckle, 2012). We tested the adequacy of our measurement model and compared it with alternative models using standard fit indices, such as the CFI, RMSEA, and SRMR (Jöreskog & Sörbom, 1993).

To test the interaction hypotheses, we used the two-step procedure of Steinmetz, Davidov and Schmidt (2011) as the residual-centering approach (Little, Bovaird, & Widaman, 2006). In a first step, the product of indicators for the independent variable and the moderator are regressed on all first-order indicators for the independent variable and moderator. The residuals for this regression are saved to the dataset. In a second step, these residuals are used as indicators of the product variable in the latent interaction model. The latent variables that we used for interaction were humility and self-efficacy, measured with five items and seven items, respectively. We reduced the number of resulting residuals to increase the validity of our SEM by lowering the variable-to-*N* ratio. To reduce the number of indicators, we used item parceling for humility and self-efficacy (e.g. Coffman & MacCallum, 2005). Parcels were constructed by first conducting factor analyses on all variables. Second, for parcel one, the mean value of items with the highest, third-highest, and fifth-highest factor loadings was calculated. Parcel two consists of the mean values of all of the remaining items. These item parcels were used instead of the original items in all of the analyses. All SEM estimates were generated through the maximum likelihood estimation technique.

### **Results**

*Preliminary analyses.* In preliminary analyses, we used a number of models to test our assumptions concerning the structural properties of our model, which examined the antecedents of error management and its implications for learning and performance. First, we tested whether the different facets of error management can be integrated into an overall error management factor. Thus, we specified a second-order error management factor explaining all

the facets of error management (error anticipation, error learning, error competence, and error risk taking). The model fit was satisfactory (CFI = .91; RMSEA = .07, SRMR = .06). All first-order error management abilities were predicted from the second-order error management factor. The factor loadings ranged between  $\gamma = .33$  ( $p < .01$ ) for error anticipation and  $\gamma = .72$  ( $p < .01$ ) for error learning.

Second, the full model of individual error management was tested. The model includes humility and self-efficacy as independent variables. Both error management and learning are mediators, and performance is the dependent variable. The model of individual error management fit the data well ( $X^2_{(483)} = 711.11$ ;  $C_{\min}/DF = 1.47$ ; CFI = .93; RMSEA = .05; SRMR = .06). The factor loadings for all variables are shown in Table 3. Means, standard deviations, and inter-correlations between all variables in the model are shown in Table 4. A graphical display of the model and all estimates for direct effects from this model are displayed in Figure 4.

**TABLE 3:**  
**Results of Confirmatory Factor Analyses**

<i>Error Management</i>		Standardized Factor Loading
Error Anticipation	←	Error Management .317
Error Learning	←	Error Management .660
Error Competence	←	Error Management .657
Error Risk Taking	←	Error Management .628
EA 1	←	Error Anticipation (EA) .448
EA 2	←	Error Anticipation (EA) .634
EA 3	←	Error Anticipation (EA) .660
EA 4	←	Error Anticipation (EA) .439
EA 5	←	Error Anticipation (EA) .498
EL 1	←	Error Learning (EL) .851
EL 2	←	Error Learning (EL) .749
EL 4	←	Error Learning (EL) .893
EC 1	←	Error Competence (EC) .461
EC 2	←	Error Competence (EC) .613
EC 3	←	Error Competence (EC) .686
EC 4	←	Error Competence (EC) .776
ERT 1	←	Error Risk Taking (ERT) .602
ERT 2	←	Error Risk Taking (ERT) .770
ERT 3	←	Error Risk Taking (ERT) .624
ERT 4	←	Error Risk Taking (ERT) .625
<i>Antecedents</i>		
Humility (Parcel 1)	←	Humility .944
Humility (Parcel 2)	←	Humility .823
Self-Efficacy (Parcel 1)	←	Self-Efficacy .821
Self-Efficacy (Parcel 2)	←	Self-Efficacy .887
<i>Implications</i>		
Learning 1	←	Learning .610
Learning 2	←	Learning .795
Learning 3	←	Learning .693
Learning 4	←	Learning .660
Performance 1	←	Performance .749
Performance 2	←	Performance .891
Performance 3	←	Performance .813

Note: Model fit for error management facets ( $X^2_{(310)} = 495.75$ ;  $C_{\min}/DF = 1.60$ ; CFI = .91; RMSEA = .07; SRMR = .06)

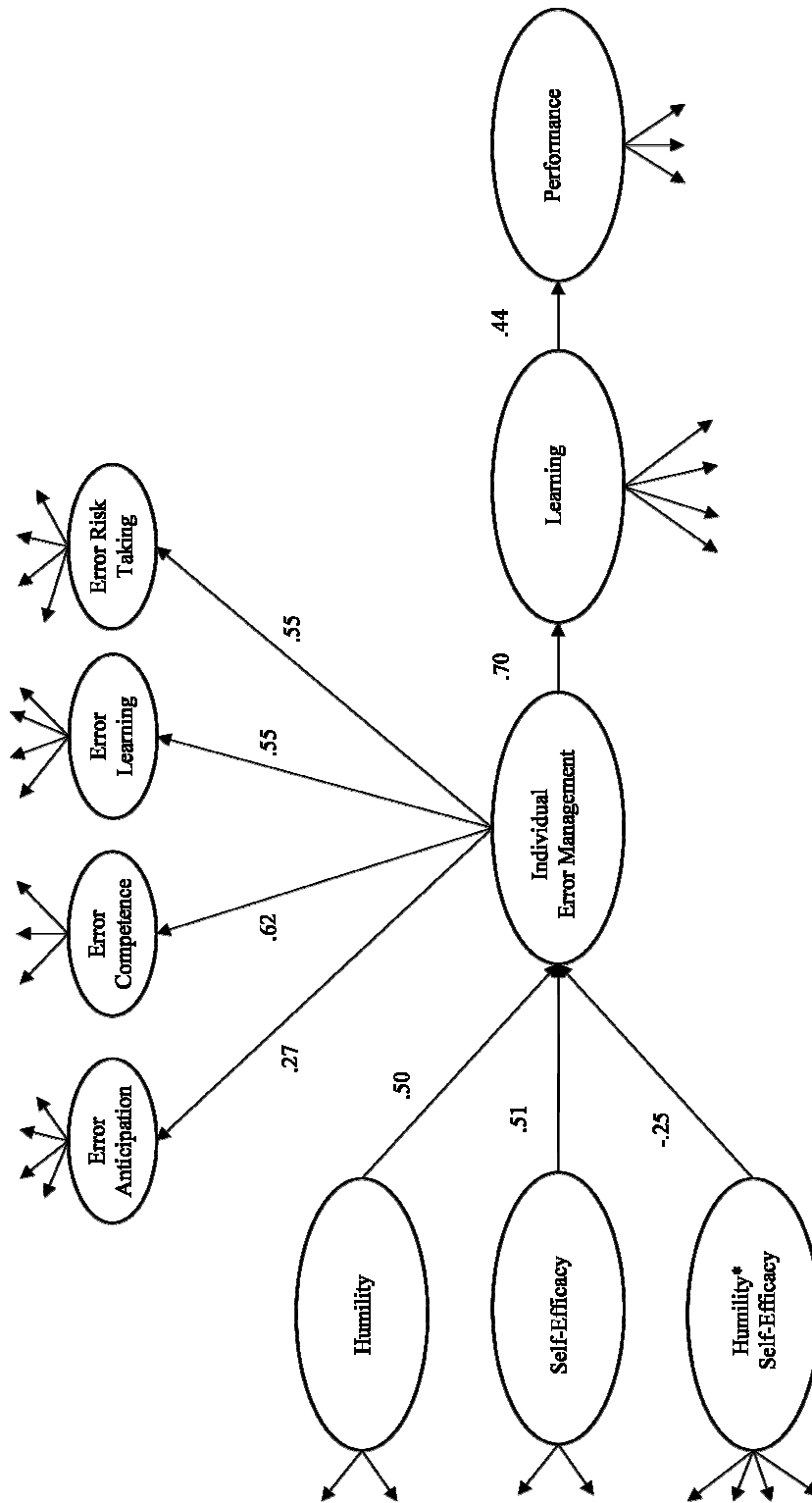
**TABLE 4:**  
**Means, Standard Deviations, and Inter-Correlations Between Study Variables**

Variable	M	SD	N	1	2	3	4	5	6	7	8	9	10
1 Age	26.69	2.17	261										
2 Gender	1.44	.50	263	-.10									
3 Error anticipation	4.24	.96	278	.00	.00								
4 Error competence	5.32	.94	277	.09	.07	.14*							
5 Error learning	5.51	1.01	277	-.01	-.07	.19**	.39**						
6 Error risk taking	4.99	.65	278	.08	-.12	.16**	.30**	.41**					
7 Error management	5.22	.96	274	.06	-.04	.64**	.65**	.68**	.68**				
8 Humility	5.68	.85	274	.09	-.05	.11	.40**	.37**	.41**	.47**			
9 Self-efficacy	5.17	.82	275	.08	-.11	.00	.23**	.21**	.28**	.24**	.28**		
10 Learning	5.69	.85	275	.04	-.05	.08	.32**	.26**	.25**	.32**	.38**	.46**	
11 Performance	10.97	1.65	261	-.03	.03	.04	.17**	.19**	.17**	.19**	.28**	.26**	.32**

Note: \*  $p < .05$ ; \*\*  $p < .01$ .



**FIGURE 4:**  
**Graphical Display of the Results for the Hypothesized Moderation Effect and the Mediation Model**

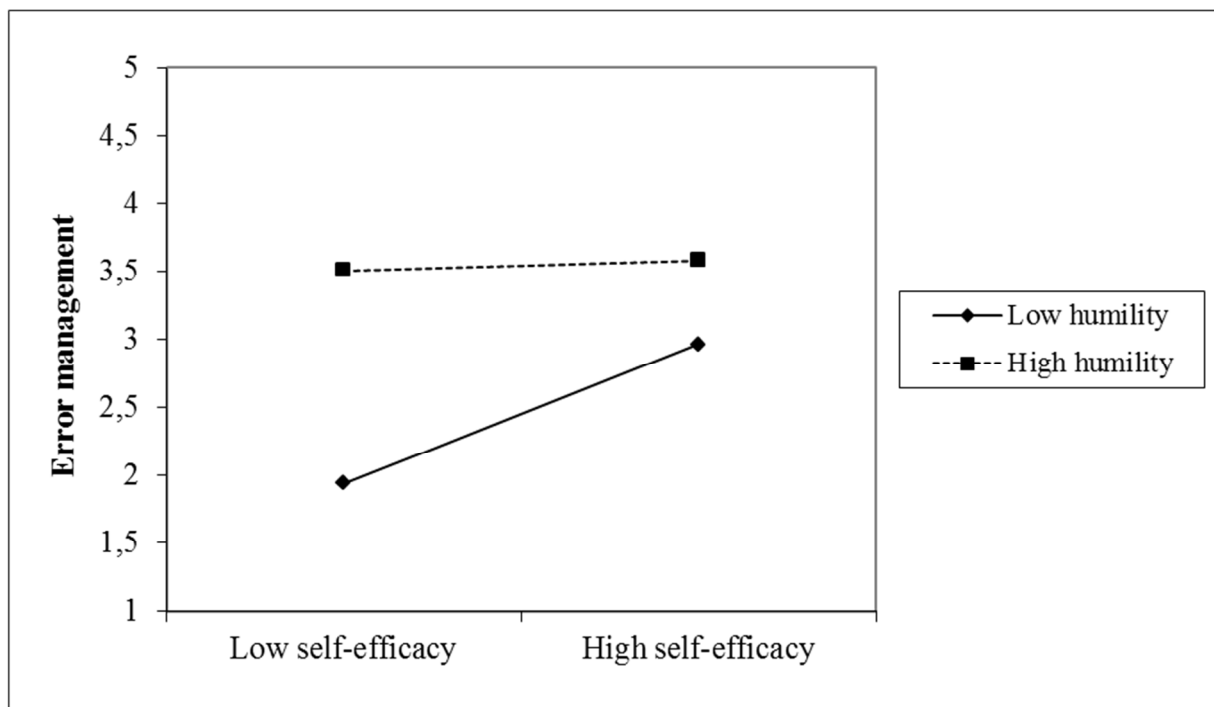


Note: All results are standardized regression coefficients.

**Hypotheses testing.** After testing the general fit of our model with the data, we assessed the individual relationships within our model to test our hypotheses. For the antecedents of error management, our hypotheses predict that both humility (*Hypothesis 1*) and self-efficacy (*Hypothesis 2*) are positively associated with error management. Our results show that both self-efficacy ( $\gamma = .17$ ; s.e. = .07;  $z = 2.57$ ;  $p = .01$ ) and humility ( $\gamma = .16$ ; s.e. = .06;  $z = 2.56$ ;  $p = .01$ ) are significantly positively related to error management. Therefore, the results support our predictions from *Hypothesis 1* and *Hypothesis 2*.

In *Hypothesis 3*, we predict that humility moderates the relationship between self-efficacy and error management, such that the relationship between self-efficacy and error management is stronger for individuals with high levels of humility. Our results show a significant, negative effect of humility\*self-efficacy on error management ( $\gamma = -.04$ ; s.e. = .02;  $z = -2.25$ ;  $p = .02$ ), thus confirming our interaction hypothesis. A graphical display of the hypothesized interaction effect of self-efficacy and humility on error management can be found in Figure 5. Figure 5 shows the hypothesized compensatory effect of humility on the relationship between self-efficacy and error management, as the relationship between low self-efficacy and error management is stronger for high humility but weaker for low humility.

**FIGURE 5:**  
**Compensatory Effect of Humility on the Relationship**  
**Between Self-Efficacy and Error Management**



In *Hypothesis 4a*, we predict that error management is positively associated with performance. Furthermore, in *Hypothesis 4b*, we predict that the relationship between error management and performance is mediated by learning, in that error management is positively related to learning and learning positively affects performance. As a first indication of mediation, our results indicate that error management is positively related to learning ( $\gamma = 1.67$ ; s.e. = .64;  $z = 2.82$ ;  $p < .01$ ) and that learning, in turn, is positively related to performance ( $\gamma = .94$ ; s.e. = .19;  $z = 4.83$ ;  $p < .01$ ). As a second indication of mediation, we specified an indirect effect from error management on performance via learning ( $\gamma = 1.57$ ; 95% CI [.70; 3.88];  $p = .01$ ). The significance of this positive indirect effect supports our notion of mediation. As a third indication for mediation, the full model was tested against two alternative models. In an alternative model, we reduced the constraints by including additional direct effects between the independent and the dependent variables. Increased fit in this model would counter our hypotheses, indicating that the above mentioned indirect effect is only a partial explanation for the effect of the independent variables on the dependent variables (i.e., partial mediation). This alternative model fit the data well ( $X^2_{(479)} = 703.01$ ;  $C_{\min}/DF = 1.47$ ; CFI = .93; RMSEA = .05; SRMR = .07), but the model fit did not improve significantly ( $\Delta DF = 4$ ,  $C_{\min} = 8.01$ ;  $p = .09$ ). This result indicates that the direct effects of the independent variables on the dependent variables do not explain relevant additional variance in the dependent variable, thereby indicating that the effect is full mediation. For another alternative model, we specified a more parsimonious structural model that treats all the independent variables, the mediators, and the moderator term as independent variables. This model shows reduced fit compared with the hypothesized mediation model ( $\Delta DF = 0$ ,  $C_{\min} = 115.82$ ;  $p = .00$ ). For all models, additional paths from the control variables (age and gender) to performance were specified, but they did not influence the model's results. In sum, these results support our argument that the relationship between error management and performance is mediated by learning.

## GENERAL DISCUSSION

Previous research on human error has been incomplete because it did not address how individuals manage error. We addressed this gap in the literature by investigating individual error management. In Study 1, we used an inductive qualitative approach to explore individual error management in a case study. The findings from our case study informed a model of individual error management. This model reveals that humility and self-efficacy are antecedents of individual error management and that individual error management is related

to learning and performance. In Study 2, we tested the model of individual error management. The results of Study 2 confirmed the hypothesized relationships within our model.

### **Strengths and Limitations**

The main strength of our study is that we combined an in-depth qualitative study involving 12 months of participant observation through 38 interviews with a quantitative approach involving a questionnaire study with 278 participants. The combination of these two approaches supported the exploration of individual error management and enabled us to test the suggested relationships in a homogeneous sample. Despite the strengths of our study, this research is not without limitations. First, although our theoretical model implies a specific causal order among the constructs, the cross-sectional data that we used to test our model do not allow us to make causal inferences. Therefore, future studies should test the causal relationships in experimental studies. Second, we explored and tested the antecedents of error management and its implications for performance in a specific setting with highly educated people. Thus, the findings on individual error management may not generalize to the overall population. Third, to measure performance, we used an external performance rating that was indicated by the participants of our study. Thus, one may doubt whether our measure of performance was objective due to the participants' self-serving bias. Nevertheless, given the strengths of the results and their importance for our understanding of human error, future research should consider the model of individual error management.

### **Theoretical Contribution**

Our model of individual error management makes three important theoretical contributions to our understanding of human error. First, our model of individual error management closes an important gap in the literature. Previous human error research has mainly addressed error prevention (Hofmann & Frese, 2011a). Only few studies have investigated the relevance of error management to understand errors and their consequences in organizations. The few studies that have investigated error management mainly focused on the organizational (Van Dyck et al., 2005) or team level (Edmondson, 1999). However, our understanding of error management on the individual level remains limited (Zhao, 2011). Filling this gap in knowledge is important because the error management approach stresses the active role that individuals play in understanding error management (Frese & Zapf, 1994; Hofmann & Frese, 2011a). We addressed this gap in the literature by proposing a model of

individual error management. This model of individual error management highlights both the importance of error management in order to understand learning and performance and suggests that there are two antecedents of error management: humility and self-efficacy.

The two antecedents of individual error management have important implications for future research on error management. Previous research has mainly argued that individuals find it inherently difficult to deal with errors (Baumard & Starbuck, 2005; Cannon & Edmondson, 2001, 2005; Van Dyck et al., 2005). As a result, previous research on error management has mainly adopted a holistic approach (Bunge, 1996; Reihlen, 2007). Such research suggests that organizations or teams have characteristics of their own (Bunge, 1996; Reihlen, 2007), such as an error management culture (Van Dyck et al., 2005) or psychological safety (Edmondson, 1999), that improve individual error management. In contrast to this dominantly holistic view of error management, our findings suggest that individuals differ in important ways in their error management. Thus, future research should take into account organizational properties and individual differences in order to gain a comprehensive understanding of error management in organizations.

Second, our findings contribute to the person approach by expanding the view of this approach in understanding failures at the sharp end. The person approach suggests that failures should be prevented by preventing errors altogether (Hofmann & Frese, 2011a; Reason, 1990a), because of the assumed negative consequences of errors. Our research findings contribute to the person approach by providing further empirical evidence that the person approach may have a second toehold. This second toehold is to increase the error management of individuals in order to decrease the negative consequences of errors such as e.g. failures. We agree with Frese and Hofmann (2011) that error prevention is important in preventing failures. Nevertheless, we believe that research based on a person approach may benefit from understanding how to increase individual error management in order to prevent failures.

Third, our findings contribute to the system approach. The assumption of the system approach is that errors at the sharp end result from work conditions and job design (Reason, 1990a; Reason, 1995). The individual plays a crucial role in this approach because individuals (alone or in cooperation with others) design their working conditions (Reason, 1995). Our findings suggest that an understanding of the individual error management of the decision maker may provide further insight into organizational error (Goodman et al., 2011) for three main reasons. First, decision makers with higher error management may anticipate organizational errors to a higher degree. Therefore, these decision makers may be more

attentive to workplace conditions that may create error-producing conditions. Second, decision makers with higher error management may be expected to recover more quickly from errors and thus to act more quickly to fix problems. Third, individuals with higher error management may learn more quickly and thus be better able to improve workplace conditions. Taken together, our findings suggest that studies using a system approach should take individual error management into account to obtain a more adequate understanding of organizational error (Ramanujam & Goodman, 2003; Reason, 1990b).

### **Practical Implications**

Our research findings are good news for managers. Anecdotal evidence suggests that the way that employees cope with errors has a strong effect on the bottom line. For example, in 2008, a French trader made initial speculation errors. Instead of stopping or learning from those errors, the trader continued to lose money, eventually totaling \$7 billion (Clark, 2012). In contrast, scientist Alexander Fleming in 1928 contaminated his petri dish samples. Instead of throwing his samples away, he stopped and took a closer look at one of the samples, eventually leading to the development of penicillin (a discovery that has helped millions of people around the world). In both of these examples, errors were initially made. What made the difference in the consequence of the errors was how those errors were managed. In this vein, our findings reveal some crucial antecedents of individual error management: humility and self-efficacy. Our research suggests that managers can improve and train individual error management by increasing individuals' humility or self-efficacy. Therefore, managers may be able to actively change the way in which individuals deal with errors and thus increase individual and organizational performance. Previous research on error management training provides interesting insights on how to design systematic error management training (Keith & Frese, 2005).

A second reason why our findings are interesting for managers is that better individual error management may be associated with less stress in the workplace. Stress is suggested as one of the main reasons for low job satisfaction, high turnover rates (Sullivan & Bhagat, 1992), and mental and physical illness (Stansfeld & Candy, 2006; Stansfeld et al., 2013). In this vein, we believe that error management reduces stress and its negative consequences because 'error management is conceptualized similarly to how others have conceptualized stress management – an approach that does not aim at changing the stressor itself but rather focusing on how to change individuals' responses to these stressors to reduce their negative consequences' (Van Dyck et al., 2005: 1228). For this reason, we believe that individuals with

higher error management are less stressed by errors. This finding may be particularly interesting for knowledge-intensive industries that are prone to errors owing to high workloads, high time pressure, and new things to be learned. The model of individual error management provides insights into the individual differences associated with better error management which organizations can use to decrease the negative consequences of workplace stress.

Furthermore, our findings provide straightforward implications for accounting firms. Accounting firms have stressed the importance of error prevention in providing high-quality services. We agree that error prevention procedures, such as trainings, written procedures, and checklists, are important. However, our findings also suggest that it is important to understand how individuals cope with occurring errors in order to understand the quality of their work. Understanding how individuals cope with errors is important because our research suggests that auditors are confronted with a multitude of errors in their jobs (despite the many error prevention mechanisms that are used in accounting firms). In this vein, our research results suggest that accounting firms may further increase their work quality by both preventing and managing errors. For example, accounting firms may integrate error management trainings into the development plans of auditors. Such training may also be useful because we found that individual error management is associated with learning and overall performance.

## **CONCLUSION**

We propose a model of individual error management. This model shows that humility and self-efficacy are antecedents of error management and that error management is related to learning and performance. Based on this model, we can now return to the beginning of the article and to Goethe's insight that *'man errs as long as he doth strive.'* Based on our findings, we respond to Goethe that it is true that man errs as long as he strives - particularly in auditing. However, more humble and self-efficacious individuals seem to leverage these errors to increase their learning and performance.

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