Continuous Auditing and Risk-Based Audit Planning - An Empirical Analysis

Marc Eulerich* Christine Georgi Alexander Schmidt#

Abstract

Due to rapidly changing risks in companies, a continuous alignment of internal audit activities with the relevant risk is required. Continuous auditing (CA) is one possible way to meet these requirements. Specifically, the internal audit function (IAF) could use CA as a methodology in order to add a continuous perspective to their risk assessment. This study examines factors associated with the use of CA information in IAF's risk-based audit planning (RBAP). We use survey data from 264 chief audit executives to address our research question. Consistent with our expectations, we find several factors having a significant positive influence on the use of information from CA in RBAP. From an IAF's perspective, these factors include the importance of data analytics, the collaboration with audit committee and external auditor, as well as the use of IAF's results for fraud prevention. Furthermore, our additional analysis presents various effects of CA on potential outputs of the IAF. Finally, we discuss the implications of these findings for research and practice.

Keywords: continuous auditing, internal audit function, risk-based audit plan

JEL classifications: G30, G32, G34, M42

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* Corresponding Author: marc.eulerich@uni-due.de

#Affiliation of all authors: University Duisburg-Essen, Mercator School of Management, Lotharstr. 65, 47057 Duisburg, Germany.

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1 INTRODUCTION

In today's dynamic and globalized world, organizations face the challenge of a rapidly changing business environment. As a consequence, organizations' risk profile needs to constantly evolve in order to adapt to these changes.

The internal audit function (IAF), as an objective and independent assurance body of an organization, has the responsibility to identify risks and unfavorable developments as well as to support the management and the audit committee (AC) with information about organizational changes. To cover all relevant issues, the Institute of Internal Auditors (IIA), especially the standard 2010 of the IIA's international professional practice framework (IPPF), recommends that "the chief audit executive must establish a risk-based plan to determine the priorities of the internal audit activity, consistent with the organization's goals" (IIA 2016).

Risk-based audit planning (RBAP) thereby can be considered as a basic approach of modern internal auditing. Based on the company-specific audit universe, a risk-based audit plan is developed, which is the starting point for the annual allocation of IAF's ressourcens and the individual engagement planning. Traditionally, the IAF used to review an organization's risk profile employing static and periodic methods (Allegrini and D'Onza 2003; Coderre 2005; Vasarhelyi and Halper 1991). However, using these static methods, potentially significant changes in the risk profile of the current fiscal year might not be covered in last year's predefined RBAP. In order to add a more dynamic, and hence a more current, perspective to its RBAP, the IAF needs a paradigm shift towards methods that allow a continuously screening of business activities for potential risks((AICPA, 2015)).

One option to do so is continuous auditing (CA). In contrast to the traditional periodic approaches to determine an organization's risk profile and audit planning, the academic literature emphasizes numerous benefits of using CA as a source of substantive data, like e.g. increased timeliness of information, 100 percent coverage of transactions, or the support of IAF's processes (Brown, Wong, and Baldwin 2007; Chan and Vasarhelyi 2011; Kearns, Barker, and Danese 2011). A recent survey by EY shows that executives see the improvement of risk assessment as the main benefit of adopting forensic data analytics such as CA (EY 2018). Another survey finds that chief audit executives (CAE) regard increased audit coverage and efficiency

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as the key objectives of data analytics and CA (Protiviti 2017). The same survey of Protiviti also illustrates that 61% of the organizations employing CA use information from CA for audit planning. One of Protiviti's main approaches is: "Leveraging CA, develop real-time snapshots of the organization's risks and incorporate results into a risk-based audit approach that is adaptable and flexible enough to focus on the highest areas of risk at any point in time". Typically, CA systems help to identify anomalies or errors on the basis of previously defined criteria.

For this purpose, the CA system accesses or extract the data of the existing ERP system and tries to generate the relevant information by means of filters, comparisons, ratios, etc.[1] The findings of these routines (red flags) represent potential audit objects, which can be included in IAF's annual audit plan. Depending on the data access and the complexity of continuous audit routines, the gathered information can be on a micro-level (e.g. a red flag for a single transaction) or macro-level (e.g. a red flag through the aggregation and analysis of data from multiple subsidiaries). Although CA helps internal auditors to raise red flags earlier as with traditional methods, the information gathered from CA has to be included in the internal audit process.

Thus, CA is one of the potential sources of information for a state-of-the-art RBAP. The combination of CA and RBAP helps the CAEs to identify relevant audit objects, to allocate IAF resources to the audit objects with the greatest risks and relevance and to reduce the inherent risk of the audit object (Deloitte 2015). Although summing up the findings analyzed above, one could assume that CA meets the new challenges set by the more dynamic risk environment, it is not commonly used by organizations (EY 2018). In order to find possible reasons for this expectation gap, we examine factors that influence the use of information from CA in IAF's RBAP. Moreover, the empirical evidence of its use by IAFs remains limited. There are only few prior studies empirically analyzing factors influencing the use of CA information in practice (Gonzalez, Sharma, and Galetta 2012; Vasarhelyi, Alles, Kuenkaikaew, and Littley 2012). Gonzalez et al. (2012) conclude that there is a lack of research identifying reasons why continuous monitoring and auditing solutions are not widely adopted. Furthermore, Vasarhelyi

[1] There are different system architectures and frameworks to implement CA in a company. While some companies directly extract data from the source system (ERP system), others use am architecture with an independent system and an additional relational database running on top of the companies ERP system. Those systems often have a read-only interaction with the application tier of the enterprise system.

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et al. (2012) show the importance of CA to satisfy the need for and ongoing a timely assurance of information. Nevertheless, they also conclude that there is still a huge gap in the profession between the theoretical implementation of CA, as a dynamic tool to align IAF resources with the current risks, and the practical implementation. Therefore, we want to address this lack of empirical research and add a new perspective to the discussion by answering the following research question:

RQ: Which factors influence the use of information from CA in IAF's RBAP?

In order to answer the research question, hypotheses with the assumed causal relationships are tested for validity in an ordinal logistic regression model. Using a multinational data set from three countries and a total of 264 observations, we include five different independent vari- ables to analyze potential effects that influence the use of information from CA in IAF's RBAP. Additionally, selected company characteristics, like industry type, listing status and size ofthe firm, are included as control variables. Our dependent variable measures the intensity of the use of information from CA in IAF's RBAP. Furthermore, an additional analysis is conducted to gain insights about potential outcomes of the use of CA information in IAF's RBAP, using different measures for IAF's performance. Finally, the validated results are discussed against the background of their importance for internal auditing. We contribute to the existing litera- ture and discussion through the identification of several factors that have a significant positive influence on the use of information from CA in RBAP. From an IAF's perspective, these factors include the importance of data analytics, the collaboration with the audit committee and external auditor, as well as the use of IAF's results for fraud prevention. This helps to add new perspectives to the practical and theoretical discussion why CA is or is not used in the IAF and which factors drive the use information from CA in the RBAP.

The remainder of this paper is organized as follows. The next section presents the current literature and develops the necessary hypothesis for our empirical approach. Section three describes the empirical model, the data set and illustrates the descriptive and regression results. Section four discusses our results and presents our conclusion.

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2 LITERATURE AND HYPOTHESES

Continuous Auditing and Risk-Based Audit Planning

First introduced by the work of Groomer and Murthy (1989) and Vasarhelyi and Halper (1991), the concept of CA has been part of the academic literature for almost three decades.[2] In the following years, the literature on CA has increased, including several literature reviews as well as studies pointing out further research questions and the relevance of this topic for the auditing profession (Brown et al. 2007; Chiu, Liu, and Vasarhelyi 2014; Eulerich and Kalinichenko 2015; Kogan et al. 1999; Kuhn and Sutton 2010; Vasarhelyi and Halper 2002).

However, several prior studies have examined auditor's use of CA (Gonzalez et al. 2012; Hardy 2014; Rikhardsson and Dull 2016; Vasarhelyi et al. 2012), continuous online auditing (El-Masry and Reck 2008; Kogan et al. 1999; Omoteso, Patel, and Scott 2008) and computer- assisted audit tools and techniques (CAATs) (Bierstaker, Janvrin, and Lowe 2014; Braun and Davis 2003; Curtis and Payne 2008; Janvrin, Bierstaker, and Lowe 2009; Mahzan and Lymer 2014). In their interview study with internal auditors, Vasarhelyi et al. (2012) examine the status of CA adoption and find, that management's support and employee's expertise in technology are influencing factors of the adoption of CA. Moreover, the authors show that most companies have problems having a "full continuous audit" system. Gonzalez et al. (2012) identify and examine factors, that influence the use of CA by internal auditors. Based on 210 responses from internal auditors, the authors find, that both, the practicality of CA and the commitment of management to CA, have a positive effect on the intention to use CA. Furthermore, Braun and Davis (2003) also conclude that training is necessary and desirable so that auditors can further promote the use of new audit techniques. Of course, the human factor behind the implementation of CA is extremely important. Thus, other factors, which influence the decision to implement and to use CA, should also be identified.[3]

[2] Although numerous definitions have been created (e. g. AICPA 1999; Alles, Kogan, and Vasarhelyi 2002; Coderre 2005; Eulerich and Kalinichenko 2015; Helms and Mancino 1999; Kogan, Sudit, and Vasarhelyi 1999; Rezaee, Sharbatoghlie, Elam, and McMickle 2002; Vasarhelyi and Halper 1991; Woodroof and Searcy 2001), there is still no common understanding of the concept of CA. The terms "continuous monitoring" and "continuous assurance" are not defined consistently either. Some authors consider them to be synonymous with CA while others see them as part of CA or separate from each other. For this study, we follow the definition of Eulerich and Kalinichenko (2015) : "CA is a (nearly) real-time electronic support system that continuously and automatically audits clearly defined "audit objects" based on pre-determined criteria."

[3] The technology acceptance model (TAM), based on the work of Davis (1985, 1989), could be used as a potential framework to evaluate the challenges and benefits of CA technology in the IAF (e.g. Vasarhelyi et al. 2012).

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Possible areas of CA applications in the internal auditing are also the integration within the framework of risk-based audit planning (Eulerich et al. 2020). The identification, assessment and monitoring of risks by the IAF enables the adequate allocation of resources of the IAF and to focus on the high-risk areas of the company. These high-risk areas might cover COSO-related risks topics, like reporting, compliance or operational risk, but can e.g. also cover financial, managerial or IT risks. Thus, RBAP tries to include both, the macro-economic and micro-enterprise risks of the organization.[4] Castanheira, Lima Rodrigues and Craig (2010) note: "Generally, risk-based auditing assesses areas of heightened risk, and, importantly, con- ducts continuous risk assessments." Coetzee and Lubbe (2014) describe RBAP as "the internal audit function's annual plan based on the organization's strategic risks." One of the main problems of RBAP is a planning process which is too static (e.g. Allegrini and D'Onza 2003; Coderre 2005; Vasarhelyi and Halper 1991). In order to add a more dynamic perspective into the planning process, many IAFs try to use technology-based audit techniques to identify, evaluate and monitor potential and current audit objects (e.g. Eulerich et al. 2020). The AICPA (2015) recommends to replace the traditional RBAP process with continuous approaches which allows to continuously screen all business activities for potential risks. Thus, CA is an optimal starting approach to constantly generate relevant data for an ongoing RBAP in the IAF. Although the existing literature provides different insights in the relationship between the use of CA and the IAF, there is a lack of research concerning the association between CA and IAF's RBAP.

Data Analytics

The IAF must plan each individual audit and consulting engagement, taking into account the objective to be pursued, the scope, timetable and resources required (IIA 2016, standard 2200 and 2201). In order to determine the individual components, it is necessary to identify and assess the inherent risks of the audit object and the controls already implemented to mitigate those risks. Data analytics is an often-used technique for audit preparation. IPPF standard 1210.A3 states that internal auditors must have basic IT risk and control knowledge and technology- based audit techniques (IIA 2016). In addition, standard 1220.A2 requires internal auditors to "consider the use of technology-based audit and other data analysis techniques" (IIA 2016).

Tools for data analytics have many different advantages for internal and external auditors, which are also examined repeatedly in the literature (e.g. Eulerich et al. 2020; Earley (2015)). These include

[4] Of course, since most of the macro-economic risks are external, a company cannot normally change the macro-environment, but instead try to react in an appropriate way.

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increasing the efficiency of audit engagements, expanding audit coverage or identifying trends (Baker 2009; Protiviti 2017). Some research papers conclude that data ana- lytics increases the independence of internal auditors (Baker 2009). There are several studies examining the use of technology and data analytics by the IAF (e.g. Eulerich et al. 2020). It turns out, that most of IAFs use data analytics in form of software solutions like ACL, Microsoft Excel and Access, IDEA or similar other tools (Baker 2009). The strong focus on data-driven internal auditing helps the internal auditors and the whole function to include modern working methods in their audit process and to integrate data as a key component into their work.

Thus, data analytics can be as a starting point for chief audit executives and internal auditors to increase their efficiency and effectiveness (e.g. Gartner 2018; Brown-Liburd, Issa and Lombardi 2015). Normally, data analytics is the starting point for IAFs to develop their analytical skillset and IT systems on their "journey" to a continuous auditing solution. KPMG (2012) states "Most internal audit organizations recognize the value and benefits of CA. However, they may lack the resources, both financial and human, or capabilities to design and implement CA processes initially. As a result, many of these organizations are beginning to lay the foundation by effectively utilizing data analytics to begin on their path toward more mature repeatable and sustainable CA processes." Data analytics, analytical procedures and finally CA can help the IAFs to use a more fact-based risk identification and evaluation and create a more dynamic risk coverage in the planning process. For external auditing, SAS No. 56 states that "Analytical procedures are an important part of the audit process and consist of evaluations of financial information made by a study of plausible relationships among both financial and nonfinancial data. Analytical procedures range from simple comparisons to the use of complex models involving many relationships and elements of data. A basic premise underlying the application of analytical procedures is that plausible relationships among data may reasonably be expected to exist and continue in the absence of known conditions to the contrary. Particular conditions that can cause variations in these relationships include, for example, specific unusual transactions or events, accounting changes, business changes, random fluctuations, or misstatements." Thus, data analytics and analytical procedures can be a starting point for the implementation of CA and help to generate additional information about potential relationships in the data.

An increasing maturity level of data analytics and analytical procedures in the audit process is a valid indicator for a stronger technology-orientation of the IAF, since CA represents the highest level of a mature data analytics approach. Especially the integration of data analytics and analytical procedures in the annual planning and preparation phase of an engagement seems of special relevance, since the results assist the auditor in planning the nature, timing and extent of the audit procedures. Thus, it seems

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appropriate that if the IAF uses information from data analytics to prepare an audit engagement, we would also expect a positive effect on the use of information from CA in IAF's RBAP. We hypothesize:

> **Hypothesis 1:** The more important the use of data analytics for audit preparation is, the more likely information from CA is used in IAF's RBAP.

Importance of the Audit Committee for the IAF

According to the IIA definition of internal auditing, the objective of the IAF is to create added value through its assurance and consulting services and to support the organization in achieving its objectives (IIA 2016). Accordingly, there is a great interest in the results and reports of the IAF. Standard 1111 demands that "the CAE must communicate and interact directly with the board" (IIA 2016). Interaction and communication with the board is further defined in the standards: When planning, the IAF must consider not only the input of senior management, but also the input of the board and the AC (IIA 2016, standard 2010.A1). Similarly, in accordance with standards 2010.A2 and 2410.A1, the CAE identifies senior management and the board's expectations of the IAF's assessments and conclusions and takes them into account in the final communication of engagement results (IIA 2016). According to standard 2020, the board must also approve IAF's annual audit plan (IIA 2016).

Previous research has found a positive link between greater AC oversight and the independence of the IAF (Carcello, Hermanson, and Raghunandan 2005). One explanation for this connection is that if senior management has more influence over the IAF than the AC, it can compromise the independence and objectivity of the IAF. This is because the IAF fears negative consequences when it questions senior management decisions (Cohen, Krishnamoorthy, and Wright 2010). There are some studies that have revealed that most IAFs report periodically to the AC (Allegrini and D'Onza 2003; Prawitt, Smith, and Wood 2009). In this context, direct reporting to the AC is mainly used as measure of the independence and objectivity of the IAF (Prawitt et al. 2009), which in turn is seen as an important factor for the independence and quality of the IAF (Abbott, Daugherty, Parker, and Peters 2016). As a supervisory body, the AC is particularly interested in fact-based reporting, where the specific results are clearly comprehensible. Thus, the use of information from CA in RBAP can directly identify deviations and realign the activities of the IAF. Therefore, the RBAP is more fact-based and less influenced by the expectations of the senior management. Hence, if the AC is of greater importance for the IAF, it can be expected that this will have a positive effect on the use of CA information in RBAP.[5]

[5] Nevertheless, there might be additional tradeoffs, if the relationship between the AC and the CAE is very close. It might be problematic if the AC emphasizes the IAF to use information from CA in RBAP, since this might impair IAF's objectivity and independence as well.

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Hypothesis 2: The more important the AC is for the IAF, the more likely information from CA is used in IAF's RBAP.

Collaboration with the external auditor

A large and growing body of literature has investigated the relationship between internal and external auditors who can both be seen as cornerstones of corporate governance (Gramling, Maletta, Schneider, and Church 2004). In particular, the external auditor's reliance decision on the IAF has been at the focus of research and is linked to several outcome effects such as impact on litigation risk, audit efficiency, audit fees and financial reporting quality (Bame- Aldred, Brandon, Messier, Rittenberg, and Stefaniak 2013). In addition, regulatory attention to this issue has increased over the last two decades. The Auditing Standard No. 5 of the Public Company Accounting Oversight Board (PCAOB) encourages the external auditor to use the relevant results of internal audit activities after reviewing the competence and objectivity of the IAF (PCAOB 2007). The external auditor should cooperate with the IAF to obtain more "evidence about the effectiveness of internal control over financial reporting" (PCAOB 2007). Thus, the external auditor has an incentive to use results of the IAF in its own audit work, while the extent of this cooperation depends on external auditor's assessment of the quality of the IAF. From the perspective of internal auditors, the reliance decision of the external auditor can be seen as an objective indicator of the quality for their work respectively their competence and objectivity. In accordance with the IIA performance standard 2050, the CAE is encouraged to coordinate the IAF's activities with other corporate governance protagonists and, where possible, to rely on the information they provide (IIA 2016). The reliance decision depends on the "competency, objectivity, and due professional care" (IIA 2016) of the other protagonist, such as the external auditor. Taken together, the IAF and the external auditor have an interest in relying on each other's work.

However, in regard to the context of this study, the determinants of the external auditor's reliance decision are of most interest. Bame-Aldred et al. (2013) summarize the results of prior studies and conclude that the reliance decision of the external auditor is mainly affected by the identity, competence, objectivity and work quality of the IAF. In addition, based on the paper of Anderson, Christ, Johnstone and Rittenberg (2012) they suggest that CA, due to its effectiveness and objectivity as an audit technique, could also lead to a higher quality of the IAF and therefore a greater extent of external auditor's reliance. Davidson, Desai and Gerard (2013) find evidence that the use of CA has a moderating effect on the difference between outsourced and in-house IAFs with respect to the reliance decision of external auditors. Therefore, it seems reasonable that the use of CA by the IAFs can improve the perceived objectivity and competence of IAFs. In addition, Malaescu and Sutton (2015) use an experimental

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approach to examine the influence of CA on the reliance decision. They find that external auditors rely more on IAFs that use information from CA in their audit approach than on more traditional IAFs without such technological audit techniques.

Overall, the empirical results suggest that the use of CA information by the IAF positively influences the external auditor's reliance decision. Thus, we hypothesize that the IAF is more likely to use CA information in its RBAP as the importance of the collaboration with the external auditors increases.

> **Hypothesis 3:** The more important the collaboration with the external auditor is for the IAF, the more likely information from CA is used in IAF's RBAP.

Rolling Planning

The IAF must allocate its resources to both audit and consulting engagements in order to perform its tasks and ensure that its priorities are consistent with and support the business objectives. In doing so, the IAF must develop an (multi-) annual plan, which covers the audit engagements to be carried out for the coming period as well as a plan for each individual audit engagement. The IIA standard 2010 requires the CAE to periodically review this audit plan and adjust it as necessary to respond to changes in risk (IIA 2016). The risks must be identified and assessed at least once a year (IIA 2016, standard 2010.A1), but due to the globalization and the digitalization of companies, the risks are changing rapidly and faster than ever. Because of the dynamic risk environment, IAF's RBAP becomes even more difficult and a flexible audit plan is needed to cover the uncertainty and complexity of companies.

It is therefore necessary to continuously monitor and evaluate the risks in the company. The annual risk assessment alone by the IAF can be dangerous if a previously unknown or low risk occurs suddenly but is not included in the predefined audit plan due to the assessment already carried out. However, it is not sufficient to monitor the risks continuously, but it is also necessary to adjust the audit plan according to the CA results, as otherwise potential changes would not be included in the audit plan. Therefore, a modern and highly qualified IAF does not use annual risk-based planning, but a continuous RBAP as a rolling forecast.

In the case of this rolling audit planning, the audit plan is also adjusted during the year if changes are required. Previous studies have shown that investments in audit technologies such as CA improve the breadth and depth of audit coverage (Baker 2009; Protiviti 2017). Modern IAFs tend to rely on information from CA in their RBAP, especially since CA supports a continuous risk identification and assessment. For this reason, it appears reasonable to expect a positive effect on the use of CA information in IAF's RBAP if the audit plan is based on rolling planning.

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Hypothesis 4: The more the IAF uses rolling planning, the more likely information from CA is used in IAF's RBAP.

Fraud Prevention

The prevention and detection of fraudulent activities is one of the main challenges facing the IAF (Coderre 2005). According to the IIA standard 2120.A2 "Internal Auditors must have sufficient knowledge to evaluate the risk of fraud". Furthermore, this standard states that "the internal audit activity must evaluate the potential for the occurrence of fraud" (IIA 2016). Risk identification and assessment of potentially fraudulent activities is therefore a core task of the IAF. The academic literature indicates that companies with an IAF are associated with a higher level of fraud detection and self-reporting (Coram, Ferguson, and Moroney 2008) and that the quality of the IAF leads to a lower level of earnings management (Abbott et al. 2016; Prawitt et al. 2009). However, the IAF's fraud prevention is becoming more complex and demanding due to a more dynamic world with evolving risk profiles of companies.

CA could be a method for the IAF to reduce the risk of fraud and to detect fraud in a timely manner (Coderre 2005). Forensic data analytics, such as CA, are effective methods for managing the risk of financial statement fraud compared to other risks (EY 2018). Inaddition, fraud prevention is a major reason for implementing CA in a company (Alles et al. 2006a; Omoteso et al. 2008). Prior studies have shown that CA is an effective approach to preventing and detecting fraud (Davidson et al. 2013; Debreceny et al. 2005; Kuhn and Sutton 2006) and that, compared to traditional audit techniques, CA provides the ability to detect fraud shortly after it occurs (Chan and Vasarhelyi 2011). However, by using an experimental approach, Gonzalez and Hoffman (2018) find that the benefits of CA as a fraud prevention technique depend on the strength of the overall monitoring system.

In summary, the empirical results indicate that CA as an audit technique can improve fraud risk management. Based on information from CA, the identified risk areas pointing to potentially fraudulent activities can be immediately covered by timely adjustments to audit planning. As a result, the continuous integration of information from CA into IAF's RBAP could improve the coverage of potential fraud incidents in upcoming audit activities. Therefore, it appears rea- sonable that if the results of the IAF are used for fraud prevention, we would expect a positive effect on the use of CA information its RBAP.

Hypothesis 5: The more the IAF results are used for fraud prevention, the more likely information from CA is used in IAF's RBAP.

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3 EMPIRICAL MODEL AND RESULTS

Data and sample selection

In order to test our conceptual model empirically, we rely on data from different CAEs. We collected data together with the Austrian, German and Swiss Institute of Internal Auditors. The study comprised 105 different closed and open questions from different areas of the internal audit profession and attempts to identify common best practices, current changes and trends. Since not all of the questions cover the topic of CA or related areas of internal auditing, we did not include all variables in the model. Furthermore, since the participation was anonymous, no further financial information etc. can be added. All questions were developed together with the three institutes in order to ensure high relevance for practitioners on the one hand and to use common quality standards for research on the other. Afterwards, the questionnaire was pretested with experienced internal auditors.[66] A survey link was sent to 2,450 CAEs from the three countries. Most of the participants were members of one of the national IIA chapters. The lists of potential participants were gathered by the national IIAs. Our overall sample represents a broad variety of companies of all sizes and from different industries. The type of respondents (CAEs) combined with the various industries and sizes can be seen as a good starting point for our study as we take into account the heterogeneity of companies and IAFs.

A total of 417 responses were collected from the invited CAEs, corresponding to a response rate of 17.02 percent. Due to missing answers in the full sample, the distribution of the sample may vary for certain questions.[7] For our model, we only include observations that have completely answered all relevant variables. We thus receive a relevant sub-sample of 264 responses.

Variables

To operationalize our hypotheses, we include 10 different variables from the questionnaire in our empirical model. A description of the variables can also be found in Appendix A Table 1. Our dependent variable, measures the intensity of the use of information from CA for RBAP. The variable has a five-point likert scale from “not at all” to “very strong”.[8]

[6] The variable descriptions in Appendix A Table 1 correspond to the questions in the questionnaire, e.g. Q: ’What are the criteria you use in your risk-based audit planning? (1 - not at all to 5 - very strong)’. A: ’Information from Continuous Auditing’.

[7] The respondents had the opportunity to skip single questions or not to answer them.

[8] Since the respondents are CAEs, we assume that they were sufficiently qualified to comprehend our main question regarding the meaning of CA in their organizational environment. Although there is a discussion about the correct definition of CA, we believe that the respondents have transferred the concepts to the question according to their own understanding.

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Our first independent variable, *DataAnalytics*, measures the importance of using data analytics for the preparation of an audit engagement with a five-point likert scale from "very low" to "very high". The variable *Importance AC* measures the relevance of the audit committee to the IAF and thus the potential impact on audit planning and IAF activities. This variable has a five-point scale ranged from "very low" to "very high" and a value "0" if the IAF does not report to the audit committee. Another variable that focuses on cooperation with other stakeholders is *Collaboration ExtAud*. It measures the importance of collaboration with the external auditor from the IAF perspective. The five-point scale also ranges from "very low" to "very high". In addition, there is the value "0", which indicates that the IAF does not cooperate with the external auditor. Our variable *RollPlanning* measures the extent to which an IAF adjusts its audit plan during the year based on rolling planning. The survey also used a five-point likert scale from "not at all" to "very strong". The last independent variable Results Fraud measures the extent to which the results of the IAF are used for fraud prevention. The variable has a scale from one to five ("very rarely" to "very often") and a value of "0", if the results are not used for fraud prevention.

Furthermore, we include different control variables. *Industry* as a dummy-variable with the value "1" for the financial industry and the value "0" for all other industries. *Listing* is also a dummy-variable with the value "1", if a company is publicly traded and otherwise "0". *Ln Employees* represents the company size measured by the natural logarithm of the number of employees. Our last control variable *Objective MTG* measures the extent to which the IAF pursues the objective of being used as a management training ground. An IAF used as management training ground can be seen as an indicator of the quality, qualification and acceptance of the IAF in a company (e.g. Carcello, Eulerich, Masli and Wood 2018). It is measured on a five-point scale, which ranges from "does not agree" to "does agree".

Analytical approach

The analytical approach consists of two major elements. First, we analyze the data descriptively in order to gain initial insights into their composition. The descriptive analysis provides the composition of the sample and the distribution of the variables used. Secondly, we use an explorative approach and test the hypotheses using appropriate multivariate techniques. All analyses are conducted with STATA. The hypothesis tests are about the multivariate effects of various factors on our dependent variable. We apply the following ordered logistic regression[9] to estimate the parameters of our model.[10]

[9] The regression uses robust standard errors, so individual standard errors are estimated and heteroscedasticity can be ignored. The estimated coefficients are constant, but the standard errors will shift slightly.

[10] The focus of our study is to obtain general results on the use of CA in IAF's RBAP. Therefore, we did not focus on country-specific influences and did not control for country-fixed effects.

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$$y_{CAAuditplan} = \beta_0 + \beta_{1} x_{DataAnalytics} + \beta_{2} x_{Importance\ AC} + \beta_{3} x_{Collaboration\ ExtAud} + \beta_{4} x_{RollPlanning} + \beta_{5} x_{Results\ Fraud} + \beta_{6} x_{ControlVariables} + \varepsilon$$

Descriptive Results

Table 2 presents the descriptive results of our 264 observations. Our dependent variable *CAAuditplan* has a mean of 2.346 and a standard deviation of 1.250. Our variable, *DataAnalytics*, about using data analytics to prepare an audit engagement has a mean of 4.084 based on a five-point likert scale, so the majority of the companies in our sample use data analytics before an audit engagement. Our variables, which focus on potential collaboration with stakeholders *Im portance AC* and *Collaboration ExtAud*, have an average of 2.612 (*Importance AC*) and 3.385 (*Collaboration ExtAud*).[11] Both variables contain numerous observations with values close to minimum or maximum. This indicates that if collaboration with relevant stakeholders is intended, such collaboration will have a significant relevance to IAFs. Our *RollPlanning* variable has a mean of 2.382. The distribution of data suggests that rolling planning is not predominantly used by IAFs in our sample during their audit planning. However, the data show that if rolling planning is used, then it is used intensively. Our last independent variable *Results Fraud* indicates that the results of the IAF are often used for the prevention of fraud, as it has a mean of 3.356.[12]

We also include different control variables. The variable *Industry* indicates that 30.7 percent of the companies in our sample are from the financial industry (mean of 0.307). We also cover the listing status of the company through the dummy variable *Listing*, which has a mean of 0.423. The total number of employees represented by the natural logarithm (*Ln Employees*) has a mean of 7.975 and a standard deviation of 1.886. Our control variable regarding the extent of the IAF's objective to be an MTG (*Objective MTG*) has a mean value of 2.273 on a five-point likert scale.

—INSERT TABLE 2 HERE—

Table 3 shows the correlation matrix and the significance levels for all variables. We have no variables with a high cross correlation and most of the individual correlations are significant. Thus, we conclude that the sample does not appear to have multicollinearity problems.

—INSERT TABLE 3 HERE—

[11] Nevertheless, due to different underlying questions, this does not indicate that the collaboration with the external auditor is more important for IAFs than the collaboration with the audit committee.

[12] Since the questions use a five-point likert scale, we do find most of our means around the "neutral" range of 2.5 to 3.5, which means more than disagreement but less than agreement. The general problem with neutral answers is, that those responses can also be interpreted as "no opinion," "unsure," or "equal/both." Nevertheless, a five-point scale is one of the most often recommend scale types, since it increases response rate and quality, while also reducing respondents' "frustration level" (see e.g. Babakus and Mangold 1992).

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Empirical Results

Our final ordered logistic regression consists of nine independent variables and a total of 264 observations. We find significant effects for 8 out of 9 variables. The Pseudo-R^2 for our model is 0.098 with a log-likelihood of -351.501 and a $\chi^2_{(9)}$ of 76.69. All regression results are presented in Table 4.

Our analysis indicates, that a strong focus on *DataAnalytics* to prepare an audit engagement has a positive significant effect on the use of information from CA in RBAP (0.396***) and thus supports H_1. *Importance AC* also has a significant positive effect (0.132**) on the use of information from CA. IAFs which assess the AC as an important addressee for their results tend to use information from CA more often in their RBAP, which provides support for H_2. In addition, we find a significant positive effect of *Collaboration ExtAud* (0.425***) on the use of information from CA in audit planning. IAF, who are more interested in collaborating with the external auditor, tend to use information from CA for their RBAP process, providing support for H_3. Our analysis also finds a significant positive effect for *RollPlanning* (0.220***), which supports H_4. This represents the positive effect of using rolling audit planning to regularly update the audit plan on the intention to use CA information in RBAP. Our last independent variable *Results Fraud* shows a significant positive effect (0.400***), indicating that IAFs with a stronger focus on fraud prevention are using information from CA for their RBAP. Thus, our hypothesis H_5 is also supported by the results.

As for our control variables, we find no significant effect for *Industry* (0.001), while there are negative significant coefficients for *Listing* (-0.577**) and *Ln Employees* (-0.159**). Finally, we identify a positive effect for the variable *Objectives MTG* (0.188**), which means that IAFs that use their function as a management training ground use information from CA more often in their RBAP.

—INSERT TABLE 4 HERE—

Additional Analysis

Afterwards, we conduct an additional analysis to identify possible impacts of using information from CA in RBAP on different IAF measures. With this additional analysis, we want to expand our view on the impact of using information from CA and identify potential positive or negative effects on various output measures of the IAF or in other words: this additional analysis should indicate whether information from CA "really matters" in the context of RBAP. Therefore, we include the following dimensions in our additional analysis:

- Stakeholder Intensity: Effects of CA on the intensity of the use of IAF results by different stakeholder (6 variables)

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- IAF Value: Effects of CA on the perceived value added of the IAF (1 variable)
- No. of Audits: Effects of CA on the number of audits performed by the IAF (1 variable)

To analyze the possible effects of CA on other IAF measures, we apply eight different dependent variables. For the first dimension "stakeholder intensity", we measure the intensity of using IAF's results by different stakeholders. We include the AC *Int AC*, the supervisory board *(Int SupBoard)*, the top management *(Int CLevel)*, the external auditor *(Int ExtAud)* and the auditee *(Int Auditee)* as potential stakeholders in our analysis. All variables are on a Likert-scale from "very low" (1) to "very high" (5). Furthermore, we create a composite measure for all prior stakeholder variables (*Sum Int*), which adds the separate five variables. For the IAF value dimension, we use the variable *Adds Value*, which measures the self-perception of the participating CAEs about the added value of the IAF on a likert-scale from "very low" (1) to "very high" (5). The third dimension, "No. of Audits" is measured with the absolute number of audits performed by the IAF in the last year. As our main independent variable of interest, we use our prior dependent variable *CAAuditplan*. Furthermore, we use the control variables from our previous model. All results are presented in table 5.

—INSERT TABLE 5 HERE—

The results indicate that the use of CA in RBAP is associated with a higher intensity of use of the IAF results by the AC (.2060***), the supervisory board (.4162***), the management (.4599***), the external auditor (.33525***) and the auditee .3359***. Consistent with these results for the individual variables, our composite measure *Sum Int*, has a statistically significant positive effect (.4134***). Furthermore, the results indicate that the perception of the IAF's value-adding role is positively affected by the use of CA information in RBAP (.1590*). Finally, we also provide a statistically significant positive effect for *Noaudits* (.2505**) indicating that the use of CA information in RBAP enables the IAF to perform more audits.

In sum, the results indicate that the use of information from CA in RBAP has a variety of positive significant effects on different output measures of the IAF. One possible explanation for the positive effects for the stakeholder dimension can be the higher level of reliability and validity in the RBAP. Furthermore, the IAF seems to add more value and perform more audits when using information from CA in the RBAP. The results from our additional analysis support the positive effects from our main analysis.

4 DISCUSSION AND CONCLUSION

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The purpose of this study is to identify and examine factors associated with the use of CA information in RBAP of the IAF. A possible argument for using information from CA as an input for the audit plan can be the dynamics in the process of a regular risk assessment (Coderre 2005). Especially because of the dynamic and uncertain business environment, a typical annual plan for the IAF activities might not be flexible enough. A large number of previous studies on this topic have discussed the possible use of information from CA as an instrument to meet the requirements of an increasing risk orientation in companies as well as factors influencing the implementation of CA. There are only a few prior studies that empirically analyze the antecedents of the actual use of CA information in practice (Gonzalez et al. 2012; Vasarhelyi et al. 2012). This limitation could be mitigated by our study. We expected that the relevance of data analytics in audit preparation and the importance of collaborating with various stakeholders, in particular the AC and the external auditor, have a positive influence on the use of CA information in the IAF's RBAP. In addition, we have assumed that the use of rolling planning in RBAP and the use of IAF's results for fraud prevention have a positive effect on the extent to which information from CA are used as a source of RBAP. An ordinal logistic regression analysis was used to answer our research question and test our hypotheses. Based on a sample of 264 responses of CAEs in a survey, we find that the factors examined have a statistically significant positive effect on the use information from CA in RBAP. In the following, the results of our regression and the impact of the results on research and practice are discussed.

Our findings suggest that IAFs, which are relying more on data analytics as part of their audit preparations, are increasing their use of information from CA as part of their RBAP. Modern IAFs seek to improve the efficiency of the overall audit process and audit planning process by using technology-based analysis methods. CA is one such method as it can support the IAF process. Our results show that an increasing importance of the AC as an addressee of audit results leads IAFs to use information from CA in their RBAP. Thus, IAFs might use CA to meet the increasing information needs of the monitoring functions in companies.

The results of our model show that the more important IAF's collaboration with the external auditor is, the more likely the IAF is to rely on information from CA in its RBAP. Especially, the use of information from CA helps both the external and internal auditor with regard to the quality of financial reporting as well as the effectiveness of the internal control system. In this context, CA supports an efficient collaboration between them and helps to avoid duplicate audits and to reduce audit fees. The positive influence on the use of information from CA through the importance of the IAF's cooperation with the external auditor and with the AC can help to ensure that regulatory and legal requirements are met. Both the AC and the external auditor are interested in detecting potential violations of regulatory

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and compliance.

With the increasing importance of rolling audit planning, the extent to which CA acts as a source of information increases. For example, based on pre-programmed checks and routines, CA is used in this context to search the company's databases in the ERP system and provides aggregated results so that the IAF continuously receives information on significant risk areas. The use of information from CA can help the IAF to be active where the company's risks are currently high. Consequently, the use of information from CA can serve the IAF as a tool to improve the reflection of the company's risk landscape, allowing the IAF to cover high risk areas through focused audits. In terms of the cost-benefit ratio of the IAF, taking into account the current risk information can also offer considerable advantages. In this way, the IAF can allocate its financial and human resources to the audit areas where the risks are most relevant from an audit perspective. CA as an audit method can improve the detection of fraud. Our study suggests that IAFs, which are actively involved in fraud prevention, integrate information from CA into their RBAP. In this way, CA could identify current fraud risks in a timely manner and increase the coverage of potential fraud risks. Finally, in our additional analysis, we examine the impact of the use of information from CA in the IAF's RBAP on different outputs of the IAF. The significant positive effects on the use intensity of IAF's results by different stakeholders, on the perception of the IAF's value added role and on the number of audits emphasize the importance of CA as a source of information for the IAF's work. The additional analysis therefore shows that not only do many IAF determinants influence the use of CA information in RBAP, but the use of CA information also influences different IAF outputs. The importance of CA in the context of the IAF is thus further enhanced. In sum, the results of both analyses pro- vide further insights on the use of information from CA, in particular on the use of information from CA as a source in RBAP of IAFs.

Our results contribute to the current discussion of possible use cases and ways to integrate CA in the internal audit process and especially RBAP. Since we were able to identify several factors that have a significant positive influence on the use of information from CA in RBAP, practitioners and researchers can use the results about the importance of data analytics, the collaboration with the audit committee and external auditor, as well as the use of IAF's results for fraud prevention, as starting points for a further analysis or as though pieces to add additional pieces to the practical and theoretical discussion about potential ways to include CA into the IAF process.

The paper is subject to certain limitations. First, our study is limited due to the different per- sonal understanding of CA in practice and in different organizations. Furthermore, the data is gathered in only three countries. The transfer of our results to other countries with e.g. different governance systems is not so simple. One opportunity for future research could be to consider comparable data from other

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countries, e.g. with a monistic board system or a mandatory IAF in companies. Furthermore, only CAEs were addressed in the survey. As a result, there may be a bias in the self-perceived position of the IAF by the participants. This is due to the fact that the data were collected from national audit institutions on the basis of a survey, without taking into account the objective of this research project. For this reason, the perceived intensity of use of information from CA is the only proxy available in the dataset. To circumvent this limitation, future research projects may choose different approaches to directly measure the actual intensity of CA use. However, as long as the addressees rate the use on an ordinal scale, it would be distorted again. Proxies that would have to circumvent this problem could measure the actual use, e.g. based on CA results or audit planning time. However, due to the sensitivity of the content and the difficulty of measuring the intensity directly, data collection in such a research approach is extremely difficult. The practical use of CA can only be estimated on the basis of our questionnaire data. This could be supplemented in further research projects, for example by experimental approaches or qualitative methods. In addition, we have no additional information about the concrete approach of using information from CA in RBAP. This lack includes both the technological solution and the process of using e.g. “red flags” of CA in RBAP. Future research can focus on the concrete implementation and approaches to integrate both areas of the IAF. Despite these limitations, this paper provides new insights into the use of CA information by IAFs and opens many potential avenues for future research.

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APPENDIX A

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Table 1: Variable Description

Dependent Variables		
Name	**Question & Description**	**Scale**
CA_Auditplan	*What are the criteria you use in your risk-based audit planning? Answer: Information from Continuous Auditing.* Measures the intensity of the use of information from CA in IAF's RBAP	1-5 (not at all to very strong)
Independent Variables		
Name	**Question & Description**	**Scale**
DataAnalytics	*How important are the following tools for your audit preparation? Answer: Data Analytics.* Measures the importance of using data analytics for the preparation of audit engagements	1-5 (very low to very high)
Importance_AC	*How important are the following stakeholders for your IAF? Answer: Audit Committee.* Measures the relevance of the AC to the IAF	1-5 (very low to very high) plus "0" if the IAF does not report to the AC
Collaboration_ExtAud	*How important is the collaboration with the following institutions? Answer: External auditor.* Measures the importance for the IAF to collaborate with the external auditor	1-5 (very low to very high) plus "0" if no collaboration
RollPlanning	*Which planning mechanisms do you use in your IAF? Answer: Rolling planning during the year.* Measures the extent to which the IAF adjusts its audit plan during the year based on rolling planning	1-5 (not at all to very strong)
Results_Fraud	*For which purposes does management use internal audit reports? Fraud Prevention.* Measures the extent to which the results of the IAF are used for fraud prevention	1-5 (very rarely to very often) and "0" if the results are not used for fraud prevention
Control Variables		
Name	**Question & Description**	**Scale**
Industry	*What industry is your company in?* Dummy variable to measure the industry type of a company	0 if non-financial industry and 1 if financial industry
Listing	*Does your company have a capital market orientation?* Dummy variable to measure if a company is publicly traded	0 if not publicly traded and 1 if publicly traded
Ln_Employees	*How many internal auditors work in your IAF (in FTE)?* Natural Logarithm of the number of employees of a company	ln(number of employees)
Objectives_MTG	*What is the objective of the internal audit function (IAF)? Preparing IAF staff for future management positions.* Measures the extent to which the IAF pursues the objective of being used as a management training ground	1-5 (does not agree to agree)

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Table 2: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
CA_Auditplan	2.346	(1.25)	1	5	335
DataAnalytics	4.084	(0.862)	1	5	392
Importance_AC	2.612	(2.121)	0	5	379
Collaboration_ExtAud	3.385	(1.303)	0	5	387
RollPlanning	2.382	(1.443)	1	5	366
Results_Fraud	3.356	(1.168)	0	5	371
Industry	0.307	(0.462)	0	1	417
Listing	0.423	(0.495)	0	1	397
Ln_Employees	7.975	(1.886)	1.099	13.305	397
Objectives_MTG	2.273	(1.329)	1	5	370

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Table 3: Cross correlation table

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CA -Auditplan (1)	1.000									
DataAnalytics (2)	0.220	1.000								
	(0.000)									
Importance AC (3)	0.112	0.012	1.000							
	(0.045)	(0.820)								
Collaboration ExtAud (4)	0.302	0.024	0.164	1.000						
	(0.000)	(0.643)	(0.001)							
RollPlanning (5)	0.179	0.089	0.078	0.088	1.000					
	(0.001)	(0.092)	(0.147)	(0.095)						
Results Fraud (6)	0.308	0.229	0.117	0.173	0.121	1.000				
	(0.000)	(0.000)	(0.028)	(0.001)	(0.025)					
Industry (7)	0.110	-0.021	0.184	0.351	0.045	-0.079	1.000			
	(0.045)	(0.679)	(0.000)	(0.000)	(0.391)	(0.127)				
Listing (8)	-0.018	-0.044	0.400	0.237	-0.004	0.113	0.177	1.000		
	(0.749)	(0.394)	(0.000)	(0.000)	(0.943)	(0.034)	(0.000)			
Ln Employees (9)	-0.052	0.064	0.197	-0.059	0.071	0.160	-0.359	0.242	1.000	
	(0.347)	(0.207)	(0.000)	(0.250)	(0.172)	(0.002)	(0.000)	(0.000)		
Objectives MTG (10)	0.170	0.098	0.133	0.098	0.176	0.193	-0.063	0.198	0.331	1.000
	(0.002)	(0.061)	(0.012)	(0.062)	(0.001)	(0.000)	(0.226)	(0.000)	(0.000)	

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Table 4: Estimation results: Ordered Logistic Regression

Variable	Coefficient	(Std. Err.)
Equation 1: CA Auditplan DataAnalytics		
	0.396**	(0.135)
Importance AC	0.132*	(0.062)
Collaboration ExtAud	0.425**	(0.109)
RollPlanning	0.220**	(0.081)
Results Fraud	0.400**	(0.109)
Industry	0.001	(0.289)
Listing	-0.577*	(0.264)
Ln Employees	-0.159*	(0.072)
Objectives MTG	0.188*	(0.092)
N	264	
Pseudo R^2	0.098	
Log-likelihood	-351.501	
$\chi 2(9)$	76.69	

Significance levels: † : 10% * : 5% ** : 1%

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Table 5: Additional Analysis: Multiple Regression Results

	Dimension							
	Stakeholder Intensity						Added Value	No. of Audits
Independent Variable	Sum_Int	Int_AC	Int_SupBoard	Int_CLevel	Int_ExtAud	Int_Auditee	Adds_Value	Noaudits
CA_Auditplan	.4134***	.2060**	.4162***	.4599***	.3525***	.3359***	.1590*	.2505**
Industry	.8054**	.7181**	.5586**	-.4097	1.048***	-.3943	-.7932**	2.302***
Listing	.7439**	.5170*	.2688	.3577	.8505***	.3940	-.1170	.0310
Ln Employees	.1692**	.1880**	.1283*	.0210	-.0131	.0870	.0394	.8072***
Objectives MTG	.1575	.1750*	.0990	.0881	.0441	.1446	-.0285	.0740
R^2	.0438	.0460	.0471	.0465	.0679	.0419	.0263	.0687
No. Obs.	181	214	250	305	288	302	304	304

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