Internal Continuous Auditing

Master Thesis

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"How can the implementation of continuous auditing be facilitated, in order to improve the adaption of continuous auditing in practice?"

Abstract
Traditional auditing has not kept pace with the real-time business environment, because traditional audits are labor and time intensive. Continuous auditing makes the traditional audit process more effective and efficient through the use of technology. However, the implementation of continuous auditing of the internal audit is quite novel in practice. The causes for this implementation of continuous auditing problem are complex and therefore, difficult to substantiate. Therefore, the objective of this paper is to provide an overview of the concept of continuous auditing and how to facilitate the implementation process of continuous auditing. Which results in some interesting insights and conclusions regarding empirical research in internal auditing.

Keywords: continuous auditing, continuous assurance, continuous monitoring, audit, information technology (IT), internal control, real-time business environment, automation, qualitative research

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Management Summary

- Research summary

Continuous auditing is a technological innovation for the internal audit. Traditional auditing has not kept pace with the real-time business environment, because traditional audits are labor and time intensive. Utilizing information technology such as continuous auditing enables auditors to provide financial statements closer to the operational process, which are reliable and credible for management and stakeholders.

Nevertheless, in practice, continuous auditing is quite novel. In the academic environment, continuous auditing has been developed, while it lacks proper empirical research and evidence which provides guidance for the practitioners. So, there is a gap in the literature between scientific theoretical development and the practical implications of continuous auditing. Furthermore, the desire for empirical research concerning continuous auditing is increasing, due to the demand for continuous assurance, by utilizing information technologies. Therefore, qualitative research is conducted regarding continuous auditing in practice. Five organizations from different sectors and five experts from different departments of EY provided information through interviews. Which results in some interesting insights and conclusions regarding empirical research in this field.

- Findings and conclusions

Continuous auditing is considered as an audit approach performed by the internal audit to conduct effective integrated auditing and monitoring by utilizing technology to continuously gather data from the operational processes and management information systems. The timing of the audits is to report events continuous by providing 100% coverage. Continuous auditing is an audit approach by means of data processing. However, this is a catch-all term, therefore the data processing is subdivided into four phases, which are described and visualized in the continuous auditing framework. The four phases consist of; data acquisition, data extraction, transformation and loading, data analyzing, and continuous auditing reporting. The continuous auditing framework is an overview of the concept of continuous auditing.

Despite, of the importance of innovation in the internal audit and the potential benefits of a successful implementation, the utilization of continuous auditing is relative low. Because the implementation is not facilitated by the current status of theoretical development of continuous auditing, there is a mismatch between theoretical development and practical implications. Additionally, the implementation process of continuous auditing requires an integral approach, which organizations should take several key elements and pre-conditions into account.

A clear overview of the implementation process could improve the practical adoption of continuous auditing. The implementation processes of continuous auditing can be facilitated by means of pilots or trials because the implementation of continuous auditing is a large and complex process. Pilots and trails offer the opportunity to learn, how to perform continuous auditing effectively and efficiently and to demonstrate the value of continuous auditing internally. Nevertheless, there is no *'good practice'* regarding the design and implementation of continuous auditing. The implementation process requires comprehensive planning of each phase of the continuous auditing process. In the case, continuous auditing is implemented, integral or to a certain extent, it provides several benefits and a more valuable audit for the organization.

Hence, the theoretical development did not correspondent with the practical needs regarding the implementation of continuous auditing. So, continuous auditing has been driving all along by its theoretical possibilities and not the practical needs. To improve the adoption of continuous auditing in practice, there should be more collaboration between practical and scientific development related to continuous auditing. This research provides an overview of the continuous auditing concept and the implementation process. Which can provide a guide for organizations to successfully implement continuous auditing, and subsequently improve the adoption of continuous auditing in practice.

- Limitations and suggestions for future research

- The generalization of the findings is limited. Due to the fact, utilization of the concept of continuous auditing is organizational specific. Therefore, a suggestion for future research is, adopting a quantitative to extent the data sample. In order to uncover the similarities between each organizational design and layout for the adaption of continuous auditing, which could provide findings which can be generalized bases on statistics.

- The data sample is limited regarding this research. Due to the fact, the concept of continuous auditing is for a lot of organizations *'still a point far on the horizon'*. Furthermore, the data sample did not consist an organization with an internal maturity level five, or in other words an integral implementation of continuous auditing. Therefore, a suggestion for future research is to conduct research at organizations with a maturity level five. In order to determine whether organizations with a mature level five provide additional information regarding the concept and implement of continuous auditing.

- The depth of understanding how the practical utilization of the concept of continuous auditing is limited. Due to the fact, the applied qualitative research methods did not enable to collect this information, because of the complexity of continuous auditing. Therefore, a suggestion for future research is conducting a case study at an organization who have implemented continuous auditing to a certain extent, and not integral. Because such an organization is in the situation which already utilized continuous auditing to a certain extent, and is still able to extent the scope, and implement continuous auditing further.

- An additional suggestion for future research is to conduct research regarding the implementation strategy of continuous auditing. Due to the fact, there are roughly two streams of implementation strategies; the waterfall approach and the agile approach. It would be helpful for organizations to clarify which implementation strategy will lead to a successful implementation.

Acknowledgements

During the last year of the master business administration at the University of Twente, a friend of mine (and now a colleague) alerted me to join Ernst & Young for an internship. I noticed, it was to time to close the chapter of being a student, and I took this opportunity. After a couple of admission tests, and meetings with my colleagues, I started my internship 7 months ago.

Ernst & Young Accountants LLP (EY) provided me with the opportunity to do an interesting graduation project by making use of the resources available within the organization. This opportunity provided me several benefits regarding my research, which opened doors that I would never have been able to do otherwise. But most importantly I was enabled to develop myself as a person, at EY.

Now my master thesis is finished, it is time to acknowledge a number of people. Without these people, I would not be able to close the chapter as being a student so smoothly. Firstly, I would like to acknowledge Maarten Buitink, my supervisor from EY. Maarten provided me with the necessary expertise and feedback at the right time, and he encouraged me to create my own solutions. Subsequently, I would like to acknowledge my colleagues at EY, despite their full schedules, they always created and took time to help me, which I really appreciate. Secondly, I would like to acknowledge my supervisors at the University of Twente, Niina Erkama and Jeroen Sempel. I would like to thank them for their opinions, feedback, and support during my internship. Furthermore, I would like to acknowledge the organizations and individuals who contributed to the practical part of my research.

I hope you will enjoy reading my research and be able to maximally profit from the content of this research. If you have any questions or comments, please do not hesitate to contact me. I will be happy to help.

Kind regards,

Bob Wiegerinck
Hengelo, 15-07-2019

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I Introduction

This part introduces the research topic, problem, objective and, question. Furthermore this part provides the context of the research.

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1 Introduction

The environment in which organizations are operating is becoming more complex, due to social and technological developments. Bennet and Lemoine (2014) describe this environment as VUCA: volatile, uncertain, complex and ambiguous. Additionally, technological developments created an environment which is becoming more data-intensive, and an environment which is becoming a real-time-economy in which organizations make decisions more rapidly (Alles, Kogan, &, Vasarhelyi, 2008; Chan & Vasarhelyi, 2011). Therefore, management and stakeholders prefer to be provided with real-time financial statements, which is useful, to make responsible, high-quality and timely business decisions. Which improves the organizational resilience in the VUCA environment. Organizational resilience is the ability to detect, anticipate, adapt, and learn from environmental changes (Lee, Vargo, & Seville, 2013). So, management and stakeholders are positioned in a changing environment, in which decisions are made more rapidly based on real-time financial statements.

Technological advancements made it possible to provide more frequent financial statements, than the traditional process of providing paper-based financial statements. Due to the fact, the organizational environment is becoming more data-intensive. These financial statements consist of financial information which is more timely, flexible, accessible, transferable, and transparent than the traditional process of providing paper-based financial statements, which are labor and time intensive (Rezaee, Sharbatoghlie, Elam, & McMickle, 2002). Furthermore, these financial statements should be reliable and credible, meaning it is free from materials errors, omissions, and fraud (Chan & Vasarhelyi, 2011; Rezaee, Elam, & Sharbatoghlie, 2001). To provide financial statements which are reliable and credible for management and stakeholders, it should be controlled by an internal and/or external auditor. So, management and stakeholders are developing demand for real-time assurance of financial statements, or in other words demand for continuous assurance.

However, traditional auditing has not kept pace with the real-time business environment, because traditional audits are labor and time intensive. Innovation in the traditional audit process, utilizing information technology such as continuous auditing, is an important step toward the development of continuous assurance (Chan & Vasarhelyi, 2011). Continuous auditing makes the traditional audit process more effective and efficient through the use of technology. The objective of continuous auditing is to bring the audit process closer to the operational process, instead of the traditional back-ward looking examination of financial statements (Alles et al., 2008). Hence, continuous auditing is a technological innovation for internal and external audit.

Nevertheless, in practice, continuous auditing of the internal audit is quite novel. In the academic environment, continuous auditing has been developed, while it lacks proper empirical research and evidence which provides the guidance for the practitioners (Chiu, Liu, & Vasarhelyi, 2014; Vasarhelyi, Alles, & Kogan, 2004). Furthermore, Gonzalez, Sharma, and Galletta (2012) point out that the number of organizations who implemented continuous auditing in practice is low. Therefore, the main objective of this research is to provide an overview of the concept of continuous auditing and to provide an overview of how the implementation of continuous auditing can be facilitated. In order to provide these overviews, the following research question is formulated: *"How can the implementation of continuous auditing be facilitated, in order to improve the adaption of continuous auditing in practice?"*. To answer the research question, there will be qualitative research conducted, concerning continuous auditing in practice.

The remainder of this paper is organized as follows. The next section discusses the background of the research and problem description. This is followed by the research methodology for conducting qualitative research. Subsequently, the theoretical background of the subjects is provided. Furthermore, the practical findings of qualitative research. Finally, discussion, conclusion, and suggestions for future research are described.

2 Problem description & research objective

As mentioned shortly in the introduction, continuous auditing is in practice quite novel. Continuous auditing is a technological innovation for internal audit. Continuous auditing makes the traditional audit process more effective and efficient through the use of technology. The objective of continuous auditing is to bring the audit process closer to the operational process. Hence, the focus of this research is continuous auditing of the internal audit.

Much of the information on the current state of continuous auditing in practice, is based on non-scientific large-scale surveys conducted by external audit firms or software vendors, which is not generalizable or transferable (Vasarhelyi, Alles, Kuenkaikaew, & Littley, 2012). The current state of continuous auditing literature lacks a proper set of experimental and empirical research (Vasarhelyi et al., 2004). So, there is a gap in the literature between scientific theoretical development and the practical implications of continuous auditing.

Scientists acknowledge this gap in the literature concerning continuous auditing. Brown, Wong, and Baldwin (2007) point out that more empirical research is needed concerning continuous auditing, which would be helpful in the research of the concept. Additionally, Alles, Brennan, Kogan, and Vasarhelyi (2006) note that empirical research will provide the facts needed to make the implementation of continuous auditing successful. A successful implementation is to provide a better understanding and use of continuous auditing, and how to perform continuous auditing effectively and efficiently (Rezaee et al., 2002). The desire for empirical research concerning continuous auditing is increasing, due to the demand for continuous assurance by utilizing information technologies.

More collaboration between continuous audit scientific research and audit practice-oriented research is a promising and valuable sign of growth. Due to the fact it will minimize the appointed literature gap (Chiu et al., 2014). Additionally, a meaningful combination of scientific and practical evidence will contribute to the guidance of a successful implementation of continuous auditing (Alles, Kogan, & Vasarhelyi, 2013; Chiu et al., 2014). So, scientific and empirical evidence compared and combined can provide useful guide for the practitioners for implementation of continuous auditing.

The literature gap described is also experienced in practice by employees of the Technology Risk department of EY, who have experienced that the concept of continuous auditing quite novel is in practice. Several experts of the Technology Risk department of EY concerning continuous auditing, point out that not every organization is capable to implement continuous auditing within their organization. It depends on the so-called maturity of the internal control of the organization. Internal control consists of structures and procedures, to provide assurance on the financial statements. Internal control is developed, to prevent, detect and correct errors (Rezaee et al., 2001). An important part of the audit is aimed at assessing the design and operational effectiveness of the internal control in organizations (Doyle, Ge, & McVay, 2007; Krishnan, 2005). Additionally, continuous auditing makes it possible to test the internal control continuously for greater certainty about the functioning of the internal control system (Vasarhelyi et al., 2012). Furthermore, internal control is a tool from the organizational resilience perspective. Due to the fact, internal control enables to detect, failures which could precede in organizational errors (Lee et al., 2013). To visualize the internal control in relation to continuous auditing, refer to figure 1.

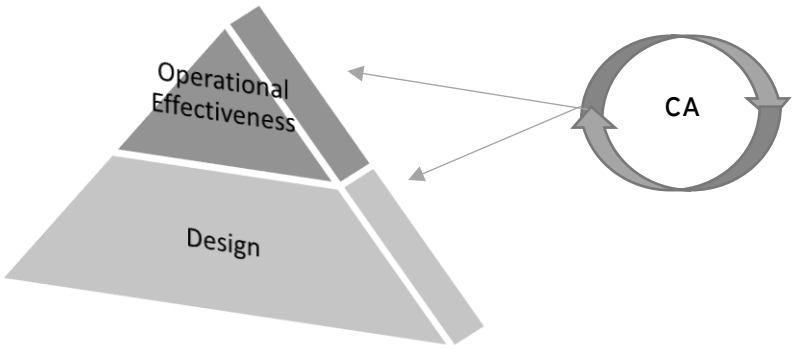

Figure 1 Internal control

However, the implementation of continuous auditing is quite novel in practice. The causes for this implementation of continuous auditing problem are complex and therefore, difficult to substantiate. Additionally, the current state of the literature on continuous auditing lacks a theory based on empirical research to clarify this implementation problem. So, continuous auditing is a worthy topic for qualitative research, which is relevant, timely, significant and interesting (Tracy, 2010). Furthermore, Feldman and Orlikowski (2010) point out that practice-based analysis of organizations are becoming increasingly widespread because it enables to understand how organizational actions are enabled or constrained. Especially, on activities and practices by strategic management, or in other words, strategy-as-practice (Vaara & Whittington, 2012). In the context of this research, it provides an understanding of how organizations are enabled or constrained by the implementation of continuous auditing.

Therefore, the objective of this paper is to provide an overview of the concept of continuous auditing and how to facilitate the implementation process of continuous auditing. Which results in some interesting insights and conclusions regarding empirical research in this field.

3 Research question and sub-questions

The following research questions are formulated, in order to meet the research objectives.

- Main research question

"How can the implementation of continuous auditing be facilitated, in order to improve the adaption of continuous auditing in practice?

Explanation: Continuous auditing is quite novel in practice. In the literature, there is a gap between scientific theoretical development and the practical implications of continuous auditing. Therefore, there will be qualitative research conducted, concerning the implementation of continuous auditing, in order to improve the adaption of continuous auditing in practice.

- Sub-questions

1. What is continuous auditing from a practical perspective?

Explanation: To understand continuous auditing, it is important to clarify the origin and definition of continuous auditing. Practical findings will provide the information if there are differences in implications of the concept of continuous auditing. Hence, a comparison of the practical implications of the concept of continuous auditing, provides an overview of continuous auditing.

2. How can the implementation process of continuous auditing be facilitated?

Explanation: This question will provide an overview, how the implementation process of continuous auditing can be facilitated. Including a description of the key elements related to continuous auditing and the continuous auditing tool.

3. How can the degree of adoption of continuous auditing increase in practice?

Explanation: This question will provide an overview of why the adoption of continuous auditing is low, and how to increase the adaption of continuous auditing. Additionally, practical findings will provide the information on what the pre-conditions are to implement continuous auditing and how to motivate organizations to adopt continuous auditing. Which will provide an overview of factors which positively influences the organizational adaption of continuous auditing.

4 Organization

In order to explain the organizational context of this research, and to put research into perspective. A portrait is described of Ernst & Young Accountants LLP (EY) and the department of Technology Risk.

Ernst & Young Accountants LLP
EY is an internationally operating, service-oriented organization. EY is an international partnership of local member firms. EY Global Limited is based in London and ensures unity in the policies of all member firms and monitors the global quality of service. At the moment, EY is operating in 150 countries and employs over 260.000 people[1]. EY is evolving their services in the areas of Assurance, Tax, Advisory and Transaction Advisory Services.

- Assurance
  In assurance are professionals helping organizations to interpret, communicate and shape the strategy around the financial statement. Using advancing technology, tools, and skills.

- Tax
  In tax are professionals helping organizations and individuals by advising on tax obligations and resolving tax controversy.

- Advisory
  In advisory are professionals helping organizations to solve pressing issues, transform the organization, and manage change and risk.

- Transaction Advisory Services (TAS)
  In TAS are professionals helping organizations to drive inclusive growth. By focusing on capital and transaction strategies through execution to drive fast-track value creation.

Technology Risk
This research is conducted at the Technology Risk department of EY in the Netherlands, which serve clients to tackle risks in technology. Especially, in the middle-north-east of the Netherlands, refer to figure 2. The department of Technology Risk is subdivided into:

- Financial IT-Audit
- Financial IT-Audit -> Financial Service Organizations
- Data & Technology

Figure 2 EY technology risk department

[1] EY Global Review 2018 Rapport: retrieved from: https://www.ey.com/en_gl/global-review/2018

II Theoretical Background

This part establish the theoretical background for the remainder of this research. The theoretical background is subdivided in several parts. Firstly, the methods of theoretical data collection and analysis is described. Secondly, the theoretical background results are per subject described.

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5 Theoretical data collection and analysis

Undertaking a literature review is an important part of the research. The objective of collecting and consulting literature is to map and asses relevant theories to provide insights and guidance for the researcher (Tranfield, Denyer, & Smart, 2003). Additionally, Wolcott (2002), describes the literature review as a shorthand to connect the research with prior work and to convey the interest of the research. Furthermore, the literature review is a tool to manage the diversity of theories. A theory is a statement of concepts and their interrelationships. It becomes a relevant theory when the theory significant contributes to the understanding of the concept and their interrelationships (Corley & Gioia, 2011). In the context of this research, several sources of literature concerning theories of continuous auditing are collected and consulted.

Firstly, systematic literature reviews concerning continuous auditing are consulted, in order to understand the concept and interrelated topics. Systematic literature reviews are essential but not sufficient to ensure validity (Oxman & Guyatt, 1993). Nevertheless, systematic literature reviews provide an overview of the current state of the literature concerning continuous auditing and provide relevant topics which are related to continuous auditing.

Secondly, articles with relevant theories will be consulted concerning continuous auditing and interrelated topics, such as continuous assurance, continuous monitoring, and (IT) audit. Articles which are involved in the theoretical data collection, are selected based on their citation index. A citation index is a type of database used in scientific literature to record which articles refer to which other articles. For example, the citation index of Scopus[2] is the prominence percentile, which is an index that is calculated by three variables; citation count, Scopus views, and average cite score. The rule-of-thumb for this research is that the citation index of Scopus should be =>55.00. Nevertheless, the prominence percentile is not applicable to articles which are not provided by Scopus. Therefore, articles which are involved in the theoretical data collection are based on their citing by Google Scholar[3]. The rule-of-thumb for this research is that the number of citations should be above =>25. However, Day and Peters (1994) point out the shortcoming of these indexes, these indexes are biased in favor of the journal, therefore some articles specially written in other languages are disadvantaged and the time effect where older articles are in favor of new articles. Therefore, expectations are made when the article includes a relevant theory, which significantly contributes to the understanding of continuous auditing and their interrelationships.

The described process of theoretical data collection is visualized, refer to Appendix A theoretical data collection. Which started with consulting systematic literature reviews of continuous auditing of Brown et al. (2007) and Chiu et al. (2014). This resulted in an overview of continuous auditing and additional relevant topics which are: internal control, (IT) audit, continuous assurance, and continuous monitoring. There is a systematic and comprehensive search conducted concerning continuous auditing and additional relevant topics. When a relevant article passes the rule-of-thumb or is an exception due to its relevancy, the article is analyzed. The articles are analyzed by hand, the process is marking important information and quotes. Subsequently, the marked quotes and information will be compared and combined based on similarity and differences, in order to understand the concepts (Oswick, Fleming, & Hanlon, 2011). The results of the theoretical data analysis, are the theoretical background per subject. Furthermore, an interrelationship of the different theories is provided, in order to understand the topics discussed in this research, refer to Appendix B and C.

[2] https://www-scopus-com.ezproxy2.utwente.nl

[3] https://scholar.google.nl/

6 Internal control

As mentioned in the problem description, not every organization is capable to implement continuous auditing within their organization. It depends on the so-called maturity of the internal control of the organization. At EY there has been a distinction made between the maturities of organizations based on internal control[4], refer to figure 3. Each level is a progression of the maturity of the internal control of the organization, which involves continuous auditing in level four and level five.

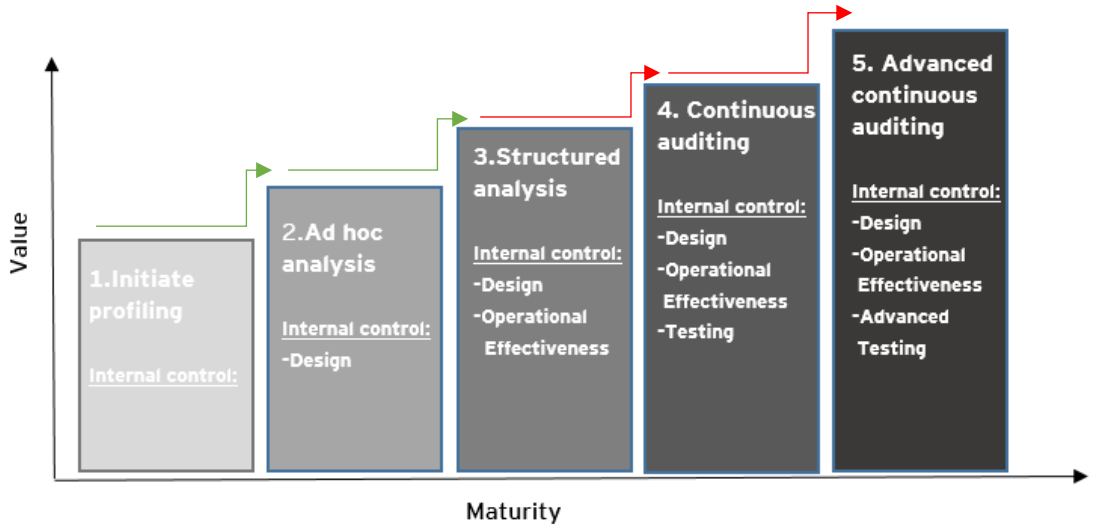

Figure 3 Level of maturity internal control

- Level 1 Initiate profiling

This level contains organizations with an internal control with only an internal control design, which is characterized by a low level of internal control. The organization lacks a formal data analytics approach, procedures or methodology to support internal control. Additionally, there are no tools available and the organization depends on the skill of a limited number of specialists. So, there is little to no internal control within the organization

- Level 2 Ad hoc analysis

This level contains organizations that recognize the value of internal control, and have an existence of the design of internal control. Nevertheless, these internal control actions are not institutionalized. Organizations have limited tools available and still rely on the skill of a limited number of specialists. So, the organization is able to substantiate their internal control design.

4 https://find.ey.net/discover EY Internal documentation

- Level 3 Structured analysis

This level contains organizations with an established internal control including design and operational effectiveness of internal control. Which means that there is formal documented what the analytic approach, procedures, and methodology are. The use of internal control actions is monitored by an internal control department or management, in which tools are used. So, the organization is able to substantiate their internal control design, and furthermore the operational effectiveness of the internal control.

- Level 4 Continuous Auditing

This level contains organizations in which the internal control actions are institutionalized into continuous auditing. Which means that the organization is able to continuously test and report over their internal control. The internal control department and management are involved in continuous monitoring of the internal controls. Advanced tools are used, to build audit plans and visual representations of data analysis results and trends. So, organizations are able to test their design and operational effectiveness of internal control.

- Level 5 Advanced Continuous auditing

This level contains organizations in which continuous auditing improves continually. Internal control department and management are able to monitor day-to-day business including operational efficiency and effectivity. So, organizations are able to test their design and operational effectiveness of internal control, more advanced than organizations in level four.

Organizations are able to improve their internal control and develop their maturity level from one to two, to three. However, experts of EY point out that organizations find it difficult to improve their internal control and develop their maturity level to four and five. Furthermore, it is important to mention that the development of maturity is only possible step-by-step, to pass over a level is not possible. So, it is in practice difficult to implement continuous auditing successful within their organization from level three to four and five. In order to provide an overview of the level of maturity per internal control, refer to figure 3.

7 (IT) Audit

The theoretical background of (IT) audit is subdivided into several parts. Firstly, the traditional audit is described. Subsequently, an IT audit is described. Finally, a distinction is made between an external and internal audit. In order to understand the objective, approach, task, and role of the audit.

7.1 Traditional audit

A traditional audit is conducted to provide assurance on the financial statements of an organization. Since 1934, this assurance method is made mandatory for public organizations (Kuenkaikaew & Vasarhelyi, 2013). Providing assurance in the modern business environment requires a thorough understanding of the ongoing changes in the ways business are organizing their activities (Alles et al., 2006). Traditionally, auditing is a backward-looking process in which tests are conducted if the financial statement is reliable and credible and it is an external disclosure of the financial statement (Rezaee et al., 2002). A traditional audit is characterized by the frequency, which is periodic, on an annual basis. Which results that material errors, omissions or fraud can go undetected for a period of time before detection by an audit (Chan & Vasarhelyi, 2011). So, the approach of a traditional audit is a reactive approach, to procure assurance.

Additionally, a traditional audit is labour and time intensive. Due to the fact, the audit procedures are conducted manually (Chan & Vasarhelyi, 2011; Vasarhelyi et al., 2012). Although the audit methods are through computers and replaced paper documentation, the processes are still manually requiring human judgement and professional skepticism. Furthermore, traditional audits are characterized by sampling. During a traditional audit, an auditor is not capable to test 100% of the data. Therefore, samples of the provided data are extracted, on which audit procedures are conducted (Rezaee et al., 2001; Rezaee et al., 2002). Kogan, Sudit, and Vasarhelyi (1999) describe the sample as a part of the scope of the audit. Francis (2004) points out that the quality of a traditional audit is difficult to measure. Due to manual procedures, sampling, and the auditor's perspective. To conclude, a traditional audit is conducted on an annual basis and requires manual audit procedures with professional judgement, in order to provide assurance on financial statements.

7.2 Information technology (IT) audit

IT is becoming increasingly important in organizations. Barua, Kriebel, and Mukhopadhyay (1995) describe that IT is tomorrow's key to competitive advantage. The impact of IT in organizations has grown exponentially, all business transactions are, entered, recorded, processed and monitored in so-called enterprise resource planning (ERP) systems (Janvrin, Bierstaker, & Lowe, 2008; Umble, Haft, & Umble, 2003). Furthermore, organizations are more relying on their IT systems to support business processes (Stoel, Havelka, & Merhout, 2012). So, IT is becoming increasingly interrelated with all business processes and organizations are more relying on their IT systems.

Furthermore, IT has significantly impacted the audit profession, audit standards, both internal and external, which encouraged auditors to involve IT in their audits, what IT is and how it should be adopted (Janvrin et al., 2008). The role of IT in audit practice is significantly increased. First, organizations are increasingly using electronic work papers to facilitate documentation. Manual audit with paper documentation is replaced by the currently used audit methods of auditing around the computer and auditing through computers (Rezaee et al., 2001). Therefore, auditors obtain evidence for the audit electronically and incorporate electronic evidence into its audit standards. Second, IT impacts the behaviour and attitudes of officers working in the organization, and IT impacts the structures and processes of the organization (Coombs, Knights, & Willmott, 1992). This is applicable to all type of organizational processes, including audit, for example, an auditor could reduce the time spent on procedures by utilizing IT in the process. Third, IT has a positive impact on audit quality and audit productivity through automating. Which eliminates enhance certain audit procedures, information, and knowledge-sharing capabilities (Janvrin et al., 2008). To conclude, IT is interrelated with and has an impact at all processes and departments of an organization.

Due to the fact, that all information is entered, recorded, processed, and monitored in IT. Management, stakeholders and auditors want to sustain on the organizational IT. Therefore, management, stakeholders and auditors developed a demand for assurance that the IT infrastructure is reliable (Stoel et al., 2012). In order to provide this assurance, internal and external auditors are auditing the IT infrastructure of the organization, or in other words, auditors are performing IT audits.

An IT audit is conducted to provide assurance of the IT systems of an organization. Therefore, an IT auditor requires to understand how IT is used, and how it should be used at an organization, as well as IT risks, IT controls, and IT audit procedures to evaluate and test IT (Weidenmier & Ramamoorti, 2006). The IT audit approach is the same as a traditional audit, reactive, and periodic on an annual basis. To conclude, IT is becoming more important in organizations, therefore IT audits are conducted. The audit approach of a traditional audit is the same as an IT audit, although the objectives differ.

7.3 Internal- and external audit

There are two forms of an audit, an internal and external audit. Both forms of the audit have the same objective, which is providing assurance on financial statements or on IT systems of an organization. Despite the similarity in the audit objective, there is a difference between these two forms of auditing concerning audit- approach, task, and role.

The internal audit is a department of an organization which evaluates and tests the design, and operational effectiveness of internal control measures in organizations (Doyle et al., 2007; Krishnan, 2005). Which is a preventive audit approach, management has the ability to solve any weaknesses in procedures before these weaknesses have a significant effect on the overall internal control system and the financial condition of the organization (Adams, 1994). In addition, Collier and Gregory (1996) point out that strengthening the internal control by internal audits leads the external audit to reduce the level of control risk, which results in less external audit work. Furthermore, less external audit work, by means of a greater contribution of the internal audit, lower the external audit costs (Felix, Gramling, & Maletta, 2001). So, the involvement of an internal department in an organization, which evaluates and tests internal controls, by means of conducting internal audits, strengthen the overall internal control system and has an impact on reducing the external audit costs.

The external auditor should acquire an understanding of internal control. By repressive evaluating the role and use of internal controls (Abbott, Parker, & Peters, 2012). Furthermore, the external audit provides independent assurance on the financial statements (Simunic, 1984). The increased use of internal auditing leads to the development that external auditors will increasingly rely on the work of the internal audit department, to reduce their external audit work (Schneider, 1985). There is considerable cooperation in external audits by internal auditors. Internal auditors may be working as assistants under the supervision of the external audit, or independently performing relevant work on which the external auditors can rely (Felix, et al., 2001). However, Goodwin and Yeo (2001) point out it depends on the organizational context whether the internal audit is independent. It depends on to what extent the internal audit is deployed, internal audit can be independently deployed in the organization, or as a management function which is staffed by employees of the organization. So, it depends on the organizational deployment of the internal audit whether the department is able to work independently or not, while the external audit is independent.

Combining the strengths of the internal and external audit should improve the quality of an audit. A higher quality audit should improve the quality of financial reporting and reduce the risk of the auditor providing an incorrect audit opinion (Goodwin-Stewart & Kent, 2006). In order to provide an overview of the two forms of auditing, refer to table 1.

	Internal Audit	External audit
Audit objective:	Provide assurance	Provide assurance
Audit approach:	Preventive	Repressive
Audit task:	Evaluating internal control: -Design -Operational effectiveness	Evaluating internal control: -Design -Operational effectiveness
Audit role:	-Assistance of external audit -(Possible) Independently	-Independently

Table 1 Internal and external audit

8 Continuous auditing

The theoretical background of continuous auditing is subdivided in several parts. Firstly, a brief description of the history of continuous auditing is described. Secondly, a comparison and combination of different definitions of the concept. Thirdly are several terms related to continuous auditing compared, in order to create a distinction. Finally, the demand for continuous auditing is described.

8.1 History of continuous auditing

Continuous auditing is an innovation in the internal audit, which is enabled by developments in information technology. The concept of continuous auditing was first introduced nearly three decades ago, in the late 80's begin 90's (Groomer & Murthy, 1989; Vasarhelyi & Halper, 1991). Continuous auditing is one of the rare instances in which innovation in auditing practice has been developed and driven by the academic community, as opposed to the usual model in which researched use data to investigate practices in a particular field (Alles et al., 2008). The introduction of this concept led to a spawn of continuous auditing research and has long been predicted as the future for the audit process. The last three decades, continuous auditing has moved from the academic world to the audit practice (Alles et al., 2006). Due to the development in information technology, audit practice realized that the traditional audit is expanding to a broader type of assurance.

The concept of continuous auditing is a response to the changing business environment. The accounting systems and procedures changed from a paper-intensive process to a data-intensive process, which changed the traditional audit process. Thus, auditors no longer consult paper documents but consult data to perform audit procedures, so the techniques of the audit procedures had to undergo some changes (Bierstaker, Burnaby, & Thibodeau, 2001; Flowerday, Blundell, & Von Solms, 2006). So, continuous auditing is developed by scientists, to innovate the audit process which responds to the changing business environment, which is slowly shifting from the academic world to the audit practice.

8.2 Definition of continuous auditing

There are in science several definitions of the concept of continuous auditing. Although the concept of continuous auditing is developed by scientists, there is no consistent definition in science. Therefore, different definitions are compared and combined to provide a definition of the concept of continuous auditing for this research.

In order to arrive at one definition of continuous auditing, several definitions are compared and combined. The most frequently cited definition of continuous auditing is developed by the joint committee of the American Institute of Certified Public Accountants (AICPA) and the Canadian Institute of Chartered Accountants (CICA) (Alles et al., 2006; Vasarhelyi et al., 2012; Chiu et al., 2014; Alles et al., 2008; Vasarhelyi et al., 2004). AICPA/CICA (1999) describe continuous auditing as follows:

A continuous audit is a methodology that enables independent auditors to provide written assurance on a subject matter, for which an entity's management is responsible, using a series of auditors 'reports issued virtually simultaneously with, or a short period of time after, the occurrence of events underlying the subject matter.

Additionally, Chan and Vasarhelyi (2011) describe continuous auditing as technological innovation. Furthermore, to add on the technological innovation, Vasarhelyi et al. (2012) describe continuous as a progressive shift in audit process towards the maximum possible degree of audit automation as a way of taking advantage of the technological basis, to reduce audit costs and increase audit automation. In addition, Rezaee et al. (2002) describe continuous auditing as a comprehensive electronic audit process to provide continuous assurance, shortly after disclosure. In contrast, to the comprehensive electronic audit process, Rikhardsson and Dull (2016) describe continuous auditing as the methodologies, processes, and technologies to enable continuous assurance on a specific subject matter. Additionally, Alles et al. (2008) describe continuous auditing as a concept to bring the audit process closer to the operational process, away from the backward-looking once-a-year examination of financial statements. Furthermore, to add on the away from the traditional backward-looking, Rezaee et al. (2002) describe continuous auditing in the context of paperless, real-time accounting of financial statements.

Hence, to provide a clear and general definition of continuous auditing, the definition should contain the aim, methods, and benefits of the concept. Therefore, a comprehensive definition is developed by comparison and combining these several definitions. This results in the following definition which will be consulted during the research:

'Continuous auditing is a concept to bring the audit process closer to the operational process. By utilizing technology to the maximum possible degree of audit automation. Which enables auditors to provide continuous assurance on a specific subject and to reduce audit costs.'

8.3 Continuous - auditing, assurance, and monitoring

Continuous auditing, continuous assurance, continuous monitoring, and other terms are related to the real-time business environment. There are certain similarities between these concepts, nevertheless, these terms are not the same, but these terms are related (Alles et al., 2006). Therefore, a distinction is made to clarify the relationship between these concepts.

First, it starts with the demand for continuous assurance, due to the business environment which is becoming more real-time in which organizations make decisions more rapidly (Alles et al., 2008; Chan & Vasarhelyi, 2011). Management and stakeholders prefer to be provided with the continuous assurance of the financial statements. Continuous auditing is an essential step toward the development of continuous assurance. Due to the fact, continuous auditing provides continuous assurance about the quality and credibility of the financial statements (Rezaee et al., 2002). Additionally, Chan and Vasarhelyi (2011) point out that continuous auditing supports and enables continuous assurance. By providing prompter and more accurate assurance on the information (Vasarhelyi et al., 2004). Nevertheless, continuous assurance does not depend on continuous auditing. In contrast, from the continuous assurance perspective, continuous auditing is a subset of a much wider range of innovative technologies which enable assurance (Kuhn & Sutton, 2010). In addition, Alles et al. (2008) point out that continuous auditing and other technologies enable and provide the demand for continuous assurance. So, there is a demand for continuous assurance and continuous auditing is a concept which enables and support this demand.

Second, is the concept of continuous monitoring. Continuous monitoring is a concept to ensure that policies, processes, business processes, and internal controls are operating effectively, in an automated manner (Chiu et al., 2014; Vasarhelyi et al., 2004). Continuous monitoring consists of the automated analysis of data on a continuous base, against a set of predetermined rules (Kuhn & Sutton, 2010). So in other words, continuous monitoring consists of monitoring of business process controls, and the detections of exceptions to these controls (Vasarhelyi et al., 2012). The demand for continuous monitoring is often driven by management and internal auditor needs, in order to assess the effectiveness of internal controls (Alles et al., 2008; Chiu et al., 2014). In addition, Brown et al. (2007) point out that continuous monitoring can assist not only management and internal audit but also external audit, to detect errors, defalcations and other breaches of the internal control system. So, continuous monitoring is the utilizing of information technologies to ensure the internal control system which results in continuous assurance.

To conclude, continuous auditing is the concept, which brings the audit process closer to the operational process, by utilizing technology to the maximum possible degree, in order to provide continuous assurance. In addition, continuous monitoring helps to ensure that policies, processes, business processes, and internal managerial controls are operating effectively, to provide continuous assurance. Additionally, the approaches of these concepts require the same basic level of information technologies utilization (Vasarhelyi et al., 2012) Therefore, continuous auditing and continuous monitoring enable and support each other while providing the same objective, which is continuous assurance. However, continuous assurance is not possible without technologies such as continuous auditing and continuous monitoring. So, it becomes a visual circle in which the concept support and enable each other. To visualize this phenomenon, refer to figure 4.

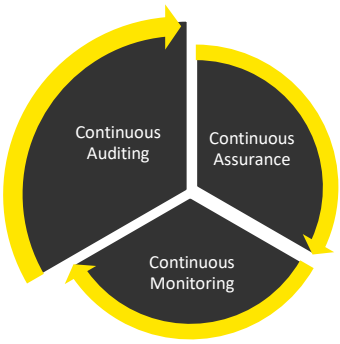

Figure 4 Continuous circle

8.4 Demand for continuous auditing

As mentioned in the introduction, the organizational environment is becoming more real-time. Therefore, management and stakeholders prefer to be provided with real-time financial statements. Hunton, Wright, and Wright (2004) argue that more frequent financial reporting enhanced the quality of business decisions. Furthermore, organizations are becoming more data-intensive. Rezaee et al. (2002) point out that the processes of organizations are computer-based stored, or in other words online. In addition, these data-intensive organizations are a complex web of information processing and data exchange (Brown et al., 2007). So, organizations are data-intensive and complex structures, while the management and stakeholders prefer faster disclosure of financial statements.

This development created a demand for continuous assurance of financial statements. Due to the fact, the real-time financial statements should be reliable and credible, which means, the financial information is free from material errors, omissions, and fraud (Chan & Vasarhelyi, 2011; Rezaee et al., 2001). In addition, accurate and reliable financial information is vital and advantageous for organizations, because it allows for close to event reporting (Chiu et al., 2014; Vasarhelyi et al., 2012). Furthermore, information is becoming less costly, faster and more feasible due to technological developments (Chiu et al., 2014). Kogan et al. (1999) describe that these developments are fueling the demand for continuous assurance of financial statements.

However, the current state of the traditional audit is not able to provide continuous assurance. Rezaee et al. (2001) point out that auditors realize that traditional audits or not efficient in the current business environment. Furthermore, the emergence of technological developments triggered the transformation of audit techniques, to adapt to the changing business environment (Cash, Baily, & Whinston, 1977). Due to the fact, that traditional audits are backward-looking and are time and cost intensive, which fits not the demand for continuous assurance. Therefore, the need for continuous assurance of information utilizing continuous auditing is becoming more apparent (Vasarhelyi et al., 2012). Due to the fact, the invested time and costs can be reduced through the use of continuous auditing in the audit process.

Furthermore, the law and regulations on financial information and financial statements are tightened up. Especially, after the recent recession compliance requirements are increased (Rikhardsson & Dull, 2016; Vasarhelyi et al., 2012). Due to all these developments, it is rather the demand side than the supply side which drives continuous auditing (Alles, Kogan, &, Vasarhelyi, 2002; Rikhardsson & Dull, 2016). To conclude, there are several developments in practice, which pull the demand for continuous auditing.

9 Benefits & Drawbacks

Once continuous auditing is successfully implemented within an organization, it enables several benefits for the organization. However, continuous auditing also enables several drawbacks for organizations to implement and utilize continuous auditing. Therefore, organizations should not only take the benefits but also the drawbacks into account when implementing continuous auditing. This chapter provides an overview of the benefits and drawbacks related to continuous auditing.

9.1 Benefits

There are several benefits of continuous auditing which have positive impact on organizations. Once continuous auditing is successfully implemented within an organization, it enables several positive benefits for the organization and the internal audit. However, continuous auditing is quite novel in practice. Therefore, an overview of potential positively benefits of continuous auditing is provided, to improve the organizational adaption of continuous auditing in practice. These benefits can be divided by means of risk and cost reduction, organizational resilience and, value creation, refer to figure 5.

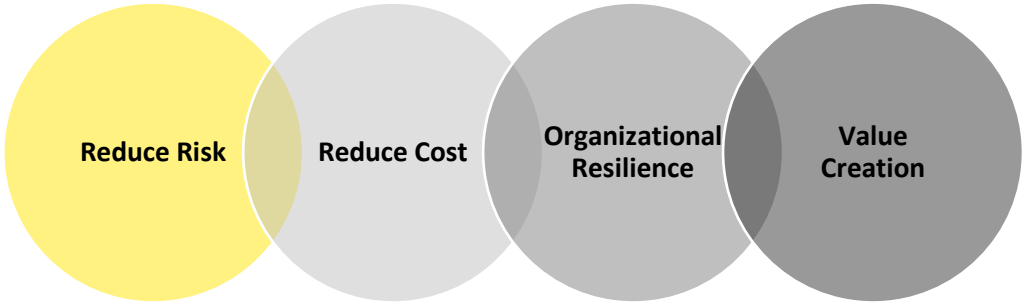

Figure 5 Benefits of continuous auditing

- Reduce risk
  Continuous auditing reduces the risk through improved process effectiveness. Due to the fact that up to 100% of the data can be tested much faster and more efficiently, by means of continuous auditing, which was previously not possible by manual audits (Rezaee et al., 2001; Rezaee et al., 2002). Due to the automation of continuous auditing, the audit process is becoming increasingly effective and it reduces errors and mistakes in the audit process (Brown et al., 2007; Vasarhelyi et al., 2012). Rikhardsson and Dull (2016) point out that continuous auditing enables to manage risk more effectively in order to provide continuous assurance. Furthermore, continuous auditing enables greater control of the internal department, and which leads to an increase in reliance on the internal audit function by the external auditors (Davidson, Gregory, & Gerard, 2013). So, the audit approach changes from reactive to detective, which reduces the risks and enables greater internal control.

- Reduce cost

  One of the main motivations for organizations to implement continuous auditing is due to the cost savings. Especially, to reduce costs on the audit (Vasarhelyi et al., 2012). Through greater productivity, increase in effectiveness, and reducing the existing workload on the audit (Alles et al., 2006). Reducing the workload on the audit results in reducing the amount of time and costs on an audit traditionally spend (Rezaee et al., 2001; Rezaee et al., 2002). Additionally, Brown et al., (2007) describe continuous auditing as a cost-effective assurance tool. So, the major benefit of implementing continuous auditing within an organization is due to the reduction of the costs of performing an audit.

- Organizational resilience

  Continuous auditing is related to organizational resilience. Organizational resilience offers two perspectives on what it means. Firstly, Dutton, Frost, Worline, Lilius, and Kanov (2002) describe organizational resilience as the ability to rebound from an unexpected situation and to pick up where they left off. Secondly, to look beyond the rebound from an unexpected situation, organizational resilience is the development of new capabilities to keep pace with and even create new opportunities (Coutu, 2002). So, in other words, organizational resilience is the ability to detect, anticipate, adapt, and learn from environmental changes (Lee et al., 2013; Lengnick-Hall, Beck, & Lengnick-Hall, 2011). Continuous auditing enables organizations to audit closer to the operational process, instead of the traditional audit which is a traditional backward-looking process (Alles et al., 2008). The possibility to audit closer to the operational process, enables organizations to detect, anticipate, adapt, and learn from environmental changes, which improves the organizational resilience. However, organizations are not able to adapt to extreme events and circumstances. Nevertheless, continuous auditing enables to improve the organizational resilience in a rapidly changing environment.

- Value creation

  Continuous auditing creates business value. Business value includes, for example, a sustainable competitive advantage, positive return on investments, higher productivity, and lower costs (Rikhardsson & Dull, 2016). Due to the fact, continuous auditing provides financial statements which are; closer to operational process, higher quality of the information, which results in continuous assurance (Alles et al., 2006; Chan & Vasarhelyi, 2011; Vasarhelyi et al., 2012). Additionally, continuous assurance of financial statements increases the confidence of management and stakeholders, which improves the speed and quality of decision-making, which can provide business value (Rikhardsson & Dull, 2016). Furthermore, continuous auditing increases the quality of external audits, by means of allowing auditors to focus more on understanding a client's business and its internal control structure (Brown et al., 2007; Rezaee et al., 2002). Despite, the benefits of continuous auditing, Farkas and Murthy (2014) argue that investors do not increase their investment in organizations who implemented continuous auditing. Due to the fact, investors do not differentiate between additional assurances provided by continuous auditing. Nevertheless, continuous auditing can deliver business value, through continuous assurance on financial statements and improvement of external audits.

9.2 Drawbacks

Despite the benefits of continuous auditing, it also enables several drawbacks for organizations to implement continuous auditing. Therefore, an overview of the potential drawbacks of continuous auditing is provided. These drawbacks can be divided by means of internal control, an increase of costs, IT-infrastructure, and human capital, refer to figure 6.

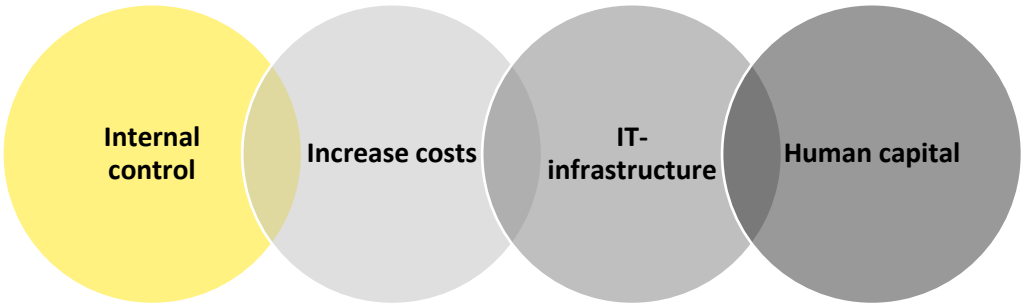

Figure 6 Drawbacks of continuous auditing

- Internal control
  Not every organization is capable to implement continuous auditing, it depends on the maturity of internal control. Vasarhelyi et al. (2012) point out that continuous auditing enables to the test the functioning of the internal control system. Therefore, organizations should have embedded an internal control system which can be assessed on the design and operational effectiveness (Doyle et al., 2007; Krishnan, 2005; Rezaee et al., 2001). Additionally, Rikhardsson and Dull (2016) point out that level of maturity of internal control influences the adoption of continuous auditing. Hence, an organization should have a certain level of maturity regarding the internal control, otherwise implementing continuous auditing is not practicable.

- Increase costs
  Implementing continuous auditing costs money. For example, Alles et al. (2002) point out that organizations do not implement continuous auditing, due to the high costs. Therefore, organizations need to consider to what extent continuous auditing is economically feasible (Pathak, Chaouch, & Sriram, 2005). Continuous auditing leads to investments in hardware and software (Kogan et al., 1999). So, continuous auditing enables cost reduction, while it leads to investments.

- IT-infrastructure

  To perform continuous auditing efficiently, the organization needs a certain level of IT-infrastructure, consisting of information systems and data access either via application programs or via extractions by the IT department (Vasarhelyi et al., 2012). Furthermore, Vasarhelyi et al. (2004) point out that implementing continuous auditing requires subsequent investment in continuous technologies to support more sophisticated continuous auditing. Additionally, Chiu et al. (2014) point out that continuous auditing cannot be performed without a strong infrastructure of automation. Moreover, Alles et al. (2008) point out that implementing continuous auditing is infeasible if an IT-infrastructure consist of legacy management information systems and applications. So, organizations should have a certain level of IT-infrastructure consisting of a high level of automation, in order to implement continuous auditing.

- Human capital

  Development regarding continuous auditing requires human capital. Chiu et al. (2014) point out that continuous auditing is driving the need for rapid knowledge development. Additionally, Vasarhelyi et al. (2012) point out to perform continuous auditing, the officers working with it, need some skills and knowledge about the technology and the audit practice. Furthermore, Rezaee et al. (2002) point out that continuous auditing put pressure on the people working with it, due to the fact it is continuously developing. So, continuous auditing requires human capital including several perspectives such as; technology, audit, and continuous auditing, which requires continuous learning and development.

10 Implementation

The theoretical background of the implementation process of continuous auditing is subdivided into several parts. Firstly, several architectures of continuous auditing are compared, to provide an overview. Secondly, the process of continuous auditing is described. Thirdly, the enabling technologies of continuous auditing are described. Finally, several strategies regarding the implementation of continuous auditing are described.

10.1 Architecture of continuous auditing

Continuous auditing requires an information technology structure for data processing and storage. Additionally, a type of analytic monitoring methodology to support continuous assurance (Brown et al., 2007). There are two types of the architectural structure of continuous auditing: internal within organizational systems and external of the organizational systems.

- Internal of the system (EAM)

Embedded audit modules (EAM) are developed and implemented within the organizational system. Groomer and Murthy (1989) introduced the EAM approach. Firstly, EAM is embedded within the application walls using the programming language of the application (Kuhn & Sutton, 2010). The application which EAM is implemented within is also known as an enterprise resource planning (ERP). Which are highly complex information systems designed for an overview of the organization including all functions and departments and a database where all business transactions are entered, recorded, processed, and monitored (Umble et al., 2003).

Secondly, EAM evaluates transactions against pre-programmed audit criteria, due to the fact that these occur in the ERP system. Thirdly, EAM is able to report violations of transactions to pre-programmed audit criteria, due to continuous monitoring of transactions. Finally, the storage of the violations also called alarms (Kuhn & Sutton, 2010). Nevertheless, the EAM approach is rarely used in practice (Alles et al., 2008). To protect the organizational ERP systems from excessive interference from auditors. To visualize the EAM procedure, refer to figure 7.

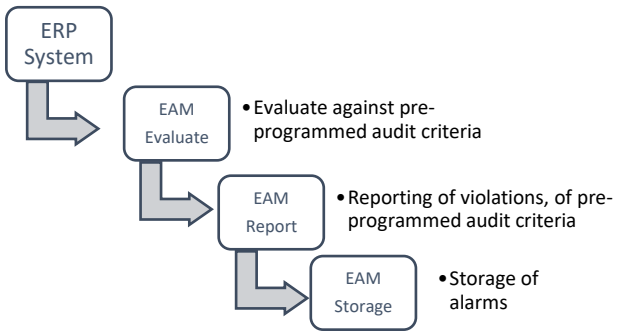

Figure 7 Embedded audit module, within ERP

- External of the system (EAM Ghosting, Audit Data Warehouse, & MCL)

  An external variant of EAM is EAM ghosting. EAM ghosting is a variant which benefits from the advantages of an EAM, yet is implemented outside the ERP system of an organization (Kuhn & Sutton, 2010). Ghosting entails operating in a 'copy' of the ERP system, in a real-time fashion. An advantage of EAM ghosting is that the organizational ERP systems are protected from excessive interference from auditors on the organizational ERP systems.

  Furthermore, an external continuous auditing architecture is an audit data warehouse. Rezaee et al. (2002) described this architecture as an optimal continuous auditing model because it combines the power of the client architecture and data will be delivered to audit workstations. The distinction with EAM ghosting is that an ERP system is not a necessary condition for an audit data warehouse (Rezaee et al., 2002). First, data is extracted from organizational corporate systems. Second, the extracted data is conversed, in standardized data. Chan and Vasarhelyi (2011), point out that extracted data should be standardized to conduct continuous auditing. Data standardization requires the development of data standards, for storing in the audit data warehouse (Rezaee et al., 2002). Third, standardized audit procedures and audit standards are stored in the audit data warehouse, to conduct continuous auditing. Furthermore, the audit data in the warehouse can be transformed into audit data marts. Data marts provide efficient sources of audit evidence for further analysis, for specific departments. Finally, the end-users are conducting tests and reports of the data on the audit workstations. In order to provide an overview of the architecture of an audit data warehouse, refer to figure 8.

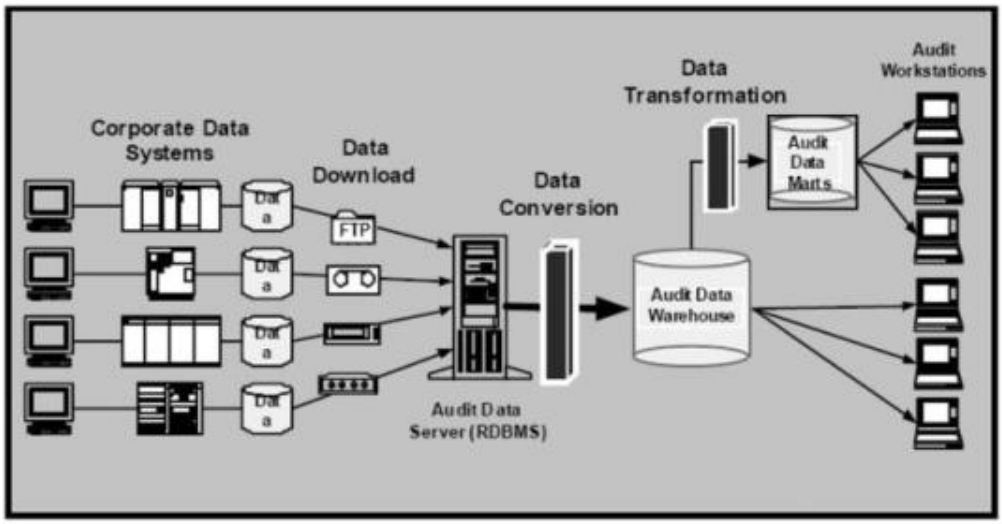

Figure 8 Architecture audit data warehouse (Rezaee et al., 2002)

Moreover, an external continuous auditing architecture is a management control layer (MCL). A MCL is an external architecture that operates independently of the organizational ERP systems to be monitored but is linked into the system and/or its underlying database to provide a similar level of monitoring (Kuhn & Sutton, 2010; Vasarhelyi et al., 2004). The management control layer is subdivided in: data provisioning, filtering layer, relational storage, measurement-standards layer, inference engine, analytic layer, alarms and alerting layer, and reporting layer. Essentially, the continuous auditing systems are implemented external of the organizational ERP system (Kuhn & Sutton, 2010). The management control layer is similar to the audit data warehouse, while the difference is that MCL is built outside, upon an organizational ERP system. Additionally, the MCL is characterized by its exception-detection capability, which is provided by the inference, analytic, alarms and alerting layers (Vasarhelyi et al., 2004). In order to provide an overview of the architecture of MCL, refer to figure 9.

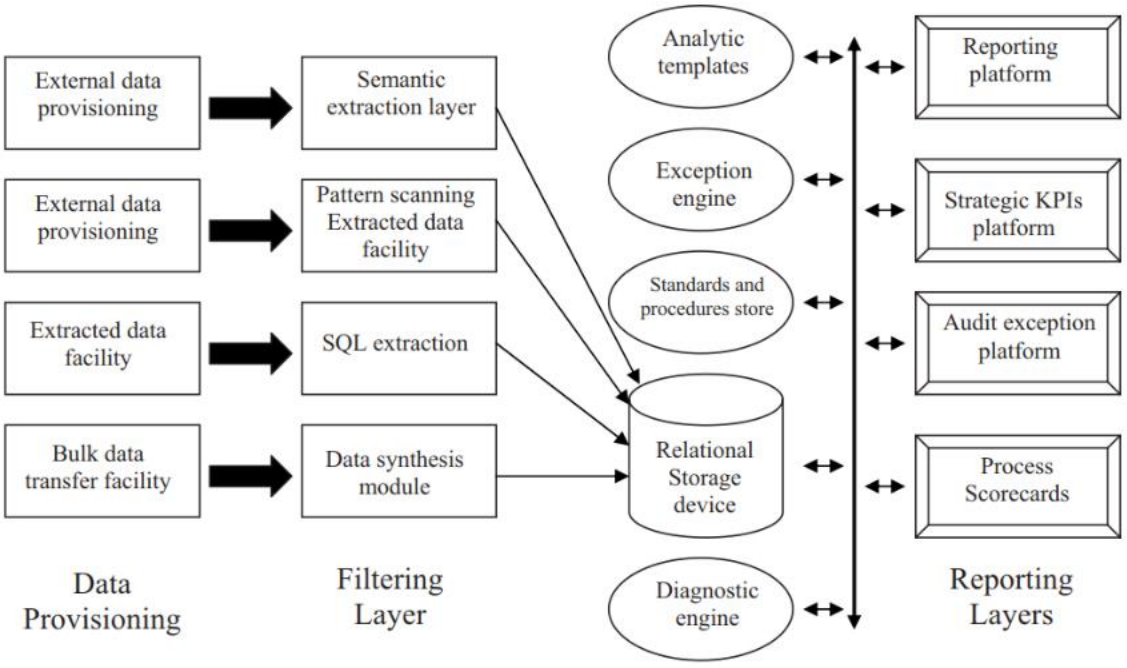

Figure 9 Architecture monitoring control layer (Kuhn & Sutton, 2010)

In order to provide an overview of the several forms of architectures of continuous auditing, refer to table 2. Which is developed based on several characteristics which are described per architecture. Importantly to note, organizations are able to develop their own architecture, which supports their individual goals and desires (Kuhn & Sutton, 2010). For example, a hybrid approach, both internal and external, or some new architecture that has yet to evolve.

	Intern	Extern		
Characteristic	EAM	EAM Ghosting	MCL	Audit Data Warehouse
Pre-programmed audit procedures	Yes	Yes	Yes	Yes
Location of audit procedures	Inside organizational system (ERP)	External hardware & software	External hardware & software	External hardware & software
Location of data and alarms	Inside organizational system (ERP)	External database	External database	External database
Continuous monitoring	Yes	Yes	No	No
ERP	Build within	Interlinked	Interlinked	No

Table 2 Overview architecture continuous auditing

Furthermore, these continuous auditing architectures and systems, or in other words continuous auditing environment, should be highly reliable for the auditor. Woodroof and Searcy (2001) describe the four principles of a highly reliable continuous auditing environment as integrity, security, availability, and maintainability. Moreover, the continuous auditing environment must be secured, which is characterized by authorization, confidentiality, integrity, and authentication (Woodroof & Searcy, 2001). The reliability and security of the continuous auditing environment are somewhat of an overlap, due to the fact these requirements serve the same objective, which is to provide assurance of the continuous auditing environment. Therefore, it is important for auditors to develop a continuous auditing architecture which meets these requirements.

10.2 Process of continuous auditing

As described in chapter 3, traditional audits are labour and time intensive, due to the manual procedures of an audit. Utilizing continuous auditing can alleviate these constraints (Chan & Vasarhelyi, 2011). Therefore, the process of continuous auditing is described to understand how these constraints of the traditional audit can be reduced.

The starting point for continuous auditing is to determine which pre-existing audit procedures can be formalized for automation and which pre-existing audit procedures cannot be formalized for automation (Alles et al., 2006; Vasarhelyi et al., 2004). Pre-existing audit procedures which can be formalized for automation, undergo a reengineering process. Due to the fact that the reengineering of traditional audit procedures is inevitable for automation of audit procedures (Alles et al., 2006; Alles et al., 2008). Subsequently, the standardization of data collection is necessary. If the data is not standardized, the auditor would have to manually adjust the data before automated audit procedures can be performed (Alles et al., 2006; Chan & Vasarhelyi, 2011). So, audit procedures and organizational data should be formalized by means of reengineering, to automate to the maximum degree as possible. Furthermore, internal control policies within an organization should be formalized, in order to support automated continuous monitoring of internal control violations (Chiu et al., 2014; Vasarhelyi et al., 2012). Vasarhelyi et al. (2012) point out that continuous monitoring consists of monitoring of business process controls, and the detections of exceptions to these controls. So, pre-existing audit procedures, data, and internal control should be formalized and standardized, to implement continuous auditing.

Standardization of audit procedures, data, and internal control policies, allow continuous auditing to run procedures with limited or without auditor intervention. Flowerday et al. (2006) describe these automated process as Continuous Auditing Tools and Techniques (CATT). Violations of these CATT's should be reported, in the form of alarms or errors, to management, internal auditors or external auditors, depending on the organizational context (Alles et al., 2008). Nevertheless, not all forms of audit procedures, data, and internal control policies are able to be formalized for automation. These procedures will still require manual performance of judgment and professional skepticism (Chan & Vasarhelyi, 2011). So, the process of continuous auditing is to reengineer existing audit procedures, data, and internal control. In order to continuous monitor and continuous audit of the organization, and to provide continuous assurance. To visualize the continuous auditing process refer to figure 10.

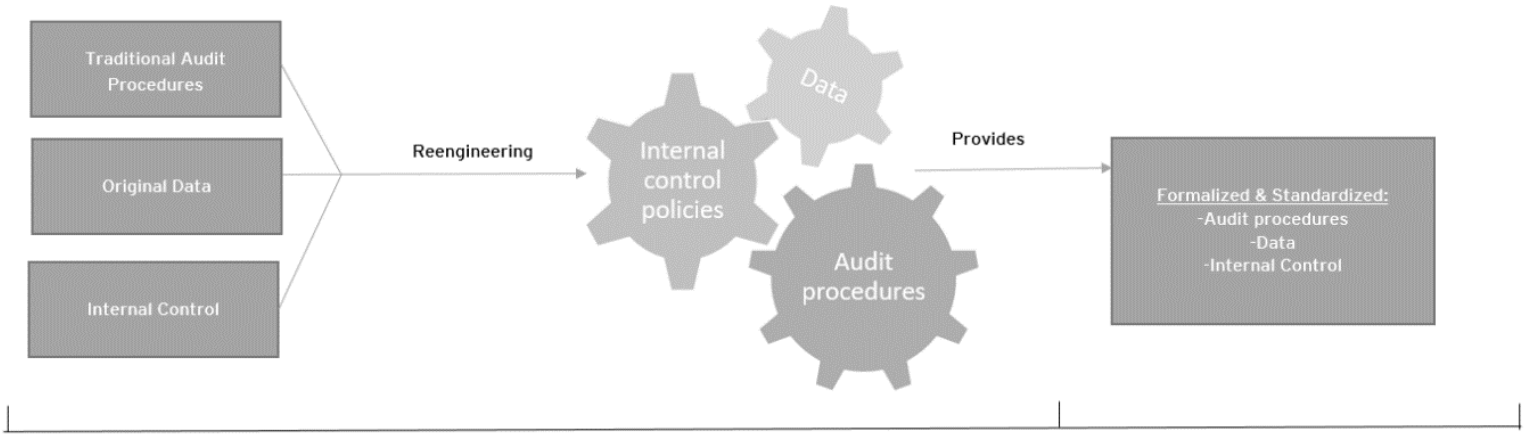

Figure 10 Continuous auditing process

10.3 Enabling technologies of continuous auditing

These forms of continuous auditing architectures and processes are enabled by utilizing technologies. There are several technologies available for continuous auditing which facilitate the implementation of continuous auditing. Such enabling technologies include; belief functions, databases, expert systems, intelligent agents, neural networks, real-time accounting and XBRL/XML (Brown et al., 2007). Additionally, Zhang, Yang, and Appelbaum (2015) discuss the possibilities of Big Data analysis in continuous auditing. Furthermore, Lins, Schneider, and Sunyaev (2016) discuss the abilities of cloud computing in continuous auditing. So, there are several technological developments which enable continuous auditing.

Most importantly is the XML (extensible mark-up language) and the XBRL (extensible business reporting langue), due to the fact these are the standards for communicating information. Rezaee et al. (2002) describe XBRL as the financial extension of XML. Woodroof and Searcy (2001) describe XBRL as a technology which provides financial information, and is able to automatically create, exchange, search, and analyze financial reporting information across disparate software applications. Rezaee et al. (2002) describe XBRL as a technology which provides a format, which is viewable and usable in different applications, thereby able to communicate between different organizations. So, XBRL enables organizations to exchange and extract financial information in a format which is applicable across all software and technologies without restrictions.

Utilizing XBRL within the organization facilitates the implementation of continuous auditing. Due to the fact, XBRL will enhance the availability, reliability, and relevance of financial information (Rezaee et al., 2002). Furthermore, there are several extensions of XBRL which also provides non-financial information, which enables the auditor to collect audit evidence for continuous auditing (Murthy & Groomer, 2004). To conclude, there are several technologies which enable continuous auditing. Nevertheless, XBRL is the basis for continuous auditing, because it facilitates continuous auditing by automatically create, exchange, search and analyze information, which is viewable and usable on different applications.

10.4 Implementation of continuous auditing

Continuous auditing has a substantive impact on the internal control of the organization (Shin, Lee, & Park, 2013). Therefore, the organization should select an implementation strategy concerning the implementation of continuous auditing. Gottschalk (1999) points out that in the 90's that regarding IT there was no definition of implementation. Despite the increasing utilization of IT, the state of literature lacked guidance for organizations on how to implement IT. This suggests that during the development of continuous auditing, there was no clear vision regarding the implementation of continuous auditing.

The literature regarding the implementation of continuous auditing, such as empirical evidence and implementation strategies is scarce. There are view studies which provided practical evidence of the implementation of continuous auditing within organizations. For example, the pilot implementation of Siemens (Alles et al., 2006), and the HSP project (Alles et al., 2008). Alles et al. (2006) have conducted a pilot implementation, in order to successfully implement continuous auditing, a team is organized which carefully planned the implementation process. This implementation processes consisted of several steps, it was a step-wise process. Additional, Alles et al. (2008) have conducted a pilot at HSP. This pilot was also carefully planned before implementing. Hence, both pilots enabled the organizations valuable information afterward, how to extend the scope of continuous auditing in an effective and efficient manner (Alles et al., 2006; Alles et al., 2008). Nevertheless, there is no literature available which provides comprehensive guidance for organizations on how to implement continuous auditing. Shin et al. (2013) point out that the implementation process of continuous auditing takes over a long period of time; as a result, there is not a large amount supportive data available, which organizations could utilize as a guide.

However, regular IT implementation strategies may facilitate the implementation of continuous auditing. Due to the fact, continuous auditing is enabled by utilizing IT. There are several perspectives regarding the implementation of IT in the current state of the literature. However, there are two main streams in the literature concerning the implementation of IT; the waterfall approach and agile approach.

The waterfall software approach is defined as the IT implementation strategy where prior to the implementation, there is a clear vision of the objectives and requirements by means of planning. The waterfall approach is first introduced in the '80s, intended for government projects (Royce, 1987). Subsequently, this approach is reengineered for the utilization of IT-implementation (Boehm, 1984). This waterfall approach is still widely utilized for the implementation of IT. The waterfall approach is characterized by its sequential method, of implementing projects or IT by means of a step-wise process (Davis, Bersoff, & Comer, 1988). The benefits of the waterfall approach are that the long-term objective(s) of the IT implementation is defined in advance, including the requirements. Which resulted in a step-wise process consisting of several different phases. However, if a phase delays or fails it has consequences for the entire implementation process and it is difficult to adopt changes during the implementation process (Dyba & Dingsoyr, 2008). For an overview of the waterfall approach, refer to figure 11.

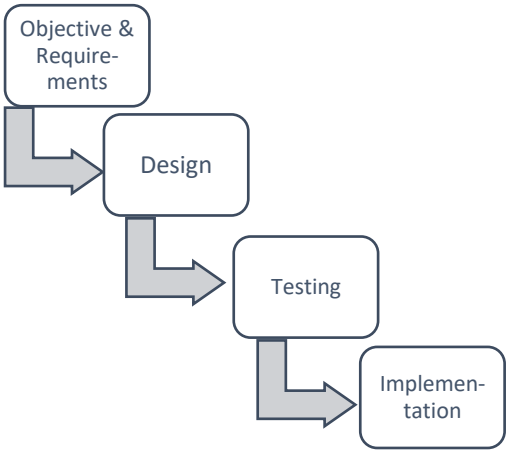

Figure 11 IT implementation waterfall approach

The agile approach is defined as the capability to survive and prosper in an environment of unpredictable change, by means of reacting quickly and effectively (Gunasekaran, 1998). The strategy of the agile approach is to reduce the cost of change, by an early win and rapid feedback (Highsmith & Cockburn, 2001). Which results in that changes are smaller and easier. Additionally, Highsmith and Cockburn (2001) point out that by utilizing the agile approach, organizations are continuous improving their concept- and implementation design. The agile approach is characterized as a major departure from traditional plan-based approaches to software engineering (Dyba & Dingsoyr, 2008). In short, the agile approach is an implementation strategy of continuous feedback & change of small implementation steps (Williams & Cockburn, 2003). So the agile approach is an alternative strategy for implementing IT, which enables to make progress by means of small steps. In order to provide an overview of the waterfall- and agile approach regarding the implementation of IT, the overview is subdivided into; objective, strategy, benefits, and drawbacks, refer to table 3.

Characteristics	Waterfall Approach	Agile approach
Objective	▸ To implement IT	▸ To implement IT
Strategy	▸ Plan-based	▸ Feedback & Change
Benefits	▸ Long-term objective(s) is defined in advance ▸ Requirements are defined in advance ▸ Step-wise process consisting of several different phases	▸ Flexible approach ▸ Early win ▸ Rapid feedback
Drawbacks	▸ If one phases fails or delays, it has consequences for the entire implementation ▸ Difficult to adopt changes during the implementation process	▸ No clear vision of the long-term objective(s) ▸ No clear vision of the requirements

Table 3 IT Implementation strategies

The waterfall approach is similar to the pilot implementations of Siemens (Alles et al., 2006), and the HSP project (Alles et al., 2008). Both pilot implementations utilized a plan-based method, consisting of sequential methods, or in other words a step-wise method. Comparing and combining this information of the pilot implementations created the step-wise-process of a continuous auditing implementation:

0. What are the motivations for the organization to implement continuous auditing?
1. Determine to what extent continuous auditing will be implemented
2. Determine which pre-existing audit procedures can be formalized for automation
3. Determine which data can be standardized
4. Determine which internal control policies can be formalized for automation
5. Develop a reengineering plan for formalization and standardization for automation
6. Develop a system architecture for continuous auditing
7. Determine which technologies can be applied to facilitate the automation
8. Develop an alarm strategy
9. Develop a continuous auditing extension plan, to extend the scope of continuous auditing

Furthermore, there are several strategies which are categorized in pre-implementation, implementation, and post-implementation (Kuruppuarachchi, Mandal, & Smith, 2002). The pre-implementation strategies consist of planning how to implement IT. The implementation strategies consist of how to execute the implementation of IT. The post-implementation strategies consist of evaluations regarding the implementation and the utilization of IT. Successful implementation of information technologies is determined by its acceptance of its users (Kuruppuarachchi et al., 2002). Therefore, the post-implementation strategies are critical for the successful implementation of IT.

Additionally, the implementation of IT and continuous auditing starts with the intrinsic motivation of the organization. Alles et al. (2006) point out that the motivation is the foundation for the implementation process of continuous auditing. These motivations are embedded within the organizational culture. The culture of an organization can have a powerful influence on how employees think and act. Organizational culture is the bundle of norms, values, and rituals that are shared by employees in an organization and is embedded within the organization (Sinclair, 1993). Additionally, Schein (1983) describes organizational culture as basic assumptions that are developed in learning to cope with its problems of external adaptation and internal integration. So, the implementation of continuous auditing is influenced by the intrinsic motivation which is embedded in the organizational culture.

To conclude, the current state of the literature lacks information and guidance for organizations to implement continuous auditing. However, adopting implementation strategies such as the waterfall approach and agile approach may facilitate the implementation process of continuous auditing. Additionally, the implementation of continuous auditing is influenced by its users, by means of intrinsic motivation which is embedded in the organizational culture. So, the successful implementation of continuous auditing depends on the motivation of the people working with it.

III Research Methodology

This part describes the research methodology, which is applied during this research. Firstly, the importance of the research methodology is described, and is a research structure developed in order to provide an overview of the research methodology. Furthermore, there is a distinction made in this part between the data collection and data analysis. Finally, is a planning of this research provided.

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11 Methodology

In order to conduct qualitative research concerning continuous auditing, a research methodology and research structure are developed. The research methodology is described to embrace standards of quality such as validity, credibility, rigor, and trustworthiness (Drisko, 2005; Morrow, 2005; Tracy, 2010). Additionally, Drisko (2005) points out that describing the research methodology provides transferability of qualitative research. Hence, other researchers can apply the research methods from one context to the second context. The research methodology provides a road map regarding how the data is collected and analyzed.

In order to create structure in the research, a research structure is developed, which is divided into five parts. The research structure is designed according to the techniques outlined by Verschuren, Doorewaard, and Mellion (2010). In order to provide an overview of the research structure, refer to figure 12.

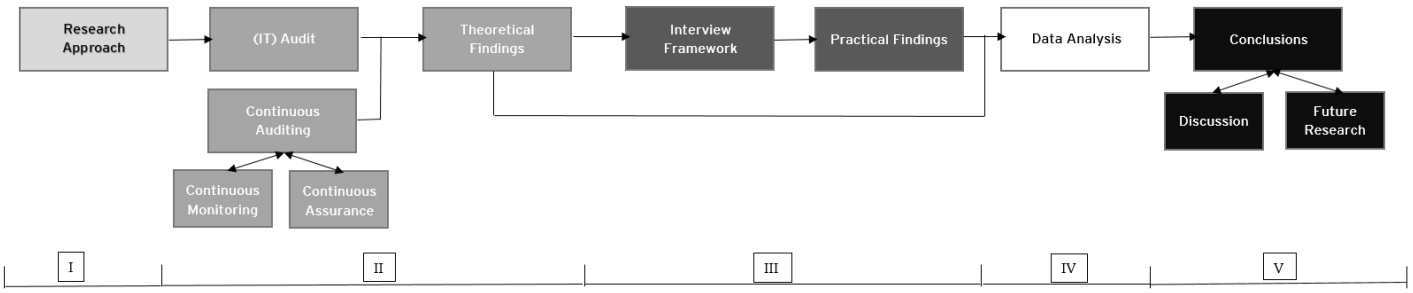

Figure 12 Research structure

Part I consists of the research approach, which includes the research problem, research objective, and research questions. Which are based on the orientation of the research topic in the literature. Furthermore, the research methodology is described in this part.

Part II consists of the theoretical data collection on the research topic. Extensive literature is consulted regarding (IT) audit, continuous auditing, continuous monitoring, and continuous assurance. This resulted in theoretical findings, or in other words the theoretical background, regarding the research topic. Part III consists of the practical data collection on the research topic. Empirical evidence is collected by qualitative research methods, regarding the research problem and objective. This resulted in the practical findings, regarding the research topic.

Furthermore, part IV consists of the qualitative data analysis of the theoretical findings and practical findings. Which results in part V, the conclusion, discussion, limitations, and suggestions for future research regarding the research topic. After this part, the results could be exposed to EY and their clients who are interested in the research topic. Furthermore, the final thesis will be finished and presented to the graduation committee.

12 Data collection

In this part is the data collection method of the qualitative research described. Drisko (2005) points out that it is important to specify the nature of data collection methods employed in the study to conduct high-quality qualitative research. High-quality qualitative research is identifiable by rich rigor. Rich rigor is recognizable with sufficient theoretical background and empirical data, using the appropriate method of data collecting (Morrow, 2005; Tracy, 2010). As mentioned in the introduction and problem formulation, the current state of the literature of continuous auditing lacks theory based on empirical research to clarify the implementation problem. Therefore, practical data will be collected concerning the research topic. Detailed data cannot be obtained by a generic survey, so it must be gathered by interviews with officers of organizations who actually implement and use the continuous auditing. Firstly, the classification for the organization that fit the research objective is described. Secondly, the objective of the interview is described.

12.1 Organization classification

As mentioned in the problem formulation, organizations find it difficult to improve their internal control and develop their maturity level from level three to four and five. In other words, to implement continuous auditing within their organization. To identify the causes for this implementation of continuous auditing problem, interviews are conducted with organizations from level three, four and, five. The sample of organizations used in the study was chosen in collaboration with EY. First, the general sample consists of the client organizations of EY. This general sample is divided, to ensure thoroughness, to help establish the credibility and validity of the research (Drisko, 2005). So, the general sample is subdivided according to the maturity level. While important to mention is that several experts of EY point out that it could be difficult to find organizations in maturity level five. Due to the fact, continuous auditing is quite novel in practice.

The sample of organizations is categorized by level three, four or five of maturity. Organizations will be classified according to the characteristics of the maturity level of figure 13, which is an extension of figure 3 from the theoretical background. The characteristics per level of maturity of internal control are based on the descriptions of Vasarhelyi et al. (2012). Organizations are classified based on several characteristics which are, level of maturity of internal control, audit objective, audit and monitoring approach, data capture and access, data automation, and analytical methods.

In order to visualize the similarities and differences between the characteristics per level of maturity, colours are linked to the level of an organization. Characteristics of level three are black, which are still black for level four and five when these are similar. Characteristics of level four are orange, which are still orange for level five when these are similar. Characteristics of level five are green. This results in a clear vision of what the similarities and difference are for the organizations per maturity level, refer to table 4 and figure 13.

Level 3 Structured analysis	
Level 4 Continuous auditing	
Level 5 Advanced continuous auditing	

Table 4 Colour per maturity level

Figure 13 Characteristics per level of maturity

- Internal control department

Most importantly, is that each organization has an internal audit department to conduct interviews with the appropriate officers. Furthermore, there is a distinction made between the levels of maturity of internal control measures in organizations. The minimum requirements of the internal control for level three are the design, and operational effectiveness of internal control measures (Doyle et al., 2007; Krishnan, 2005). Additionally, continuous auditing enables to test the internal control continuously for greater certainty about the functioning of the internal control system (Vasarhelyi et al., 2012). The minimum requirements of the internal control for level four are that the organization is able to test continuously of internal control measures. Furthermore, level five is able to test advanced continuous which entails more sophisticated and comprehensive testing.

- Audit objective

For each level of maturity, the objective of an audit is to provide assurance of financial statements (Vasarhelyi et al., 2012). However, organizations in level three, are obtaining assurance on a periodic basis, by means of manual audits. Organizations in level four and five, are obtaining continuous assurance by means of continuous auditing. By means of the verification of the quality of internal controls. However, organizations in level 4 do not have reached the full scope of continuous auditing internal controls, while organizations in level five have reached the full scope of continuous auditing internal controls.

- Audit & monitoring approach

The audit and monitoring approach is the extent to which outputs shifts from being periodic to being undertaken continuously (Vasarhelyi et al., 2012). Organizations in level three, are auditing and monitoring on a periodic basis, or in other words backward-looking. For example, on an annual basis, semi-annual basis or quarterly basis. Chan and Vasarhelyi (2011) point out that material errors, omissions or fraud can go undetected for a period of time before detection by an audit. Organizations in level four and five, are auditing and monitoring continuously enabled by automated audit procedures and audit standards. Organizations in level four, use alarms as evidence for errors and or violations of audit procedures and standards. In the case of an alarm or violation, these are resolved manually on a periodic base. Organizations in level five, use early warning systems of errors, which detect errors and respond immediately. So, the period of time before detection, of material errors, omissions or fraud, is in level three longer than in level four and five.

- Data capture & access

The data capture and access is the degree to which the auditor is able to capture and access organizational data (Vasarhelyi et al., 2012). Organizations in level 3 are capturing data momentum driven, so periodically to support the audit cycle. Furthermore, there are limitations and barriers in the organizational data access for the audit. Organizations in level 4 are capturing data systematically and continuously, while limitations of data access still exist for the audit. Organizations in level 5 are capturing data systematically and continuously, there are no limitations or barriers to the audit, so enterprise-wide data is captured and accessible.

- Audit automation

Audit automation is the degree to which audit processes are automated (Vasarhelyi et al., 2012). Organizations in level three, are conducting audit processes manually. Organizations in level four, are conducting audit processes to a certain degree automated, while there is still room for extending the scope of automation. Organizations in level five, are conducting audit processes to the maximum possible degree automated. Which entails that only audit processes which require human judgment and professional skepticism, are conducted manually.

- Analytical methods

Analytical methods are the degree of technical sophistication of analytical procedures, that the internal audit performs (Vasarhelyi et al., 2012). Organizations in level three, utilize basic analytical methods by means of simple tools. For example, calculating financial ratios by means of Excel. Organizations in level four, utilize advanced analytical methods by means of advanced tools. For example, KPI level monitoring, or structural continuity equations by means of developed dashboards, to generate graphs that show trends. Organizations in level five, utilize comprehensive advanced analytical methods, by means of comprehensive advanced methods. For example, corporate models of the main business by means of automated advanced software applications and tools.

12.2 Interviews

Interviews will be the primary source of the collection of practical data. Eisenhardt and Graebner (2007) point out that interviews are a highly effective way to gather rich, practical data. Nevertheless, interviews are stigmatized, that the data is biased due to subjectivity. The challenge is to limit this bias, by using numerous and highly knowledgeable interviewees who view continuous auditing from diverse perspectives. Additionally, there should be a balance between excessive passivity and over-direction of the interview, to receive rich, practical data (Walsham, 1995). Therefore, is a semi-structured and open-ended interview framework developed, to obtain an in-depth understanding of the practical attitudes towards continuous auditing.

In the context of continuous auditing, the interviewees are continuous auditing experts of EY and officers from the internal audit department of organizations, due to the fact that these experts and officers actually implement and work with continuous auditing. In addition, Vasarhelyi et al. (2012) point out that internal auditors need some skills and knowledge about technology and audit practice. Therefore, the background information of the interviewees will be collected, to take this factor into account. Firstly, expert interviews are conducted with employees of EY. Especially employees who are experts in the field of continuous auditing. Who provide insights in, the general objective of an (IT) audit and continuous auditing. Subsequently, interviews are conducted with organizations in the maturity level of three, four, and five.

The content of the semi-structured open-ended interview framework is based on several sources. Firstly, based on the insights of the continuous auditing experts of EY. Secondly, based on the literature of Rikhardsson and Dull (2016) and Vasarhelyi et al. (2012), these authors have developed an interview guide and master questionnaire guide regarding continuous auditing in practice. Combining the expert interviews and literature, resulting in an interview guide for this research, refer to Appendix D and E. To ensure the validity and reliability of the interview questions, the interview was piloted to ensure the provision of useful research data (Omoteso, Patel, & Scott, 2008). So, several sources are consulted and combined to arrive at a comprehensive interview guide for continuous auditing.

There are several ways of data collection of interviews. Data can be collected by means of recording the interviews. The advantage is that it provides a full description of the topics that are discussed, the disadvantage is that it costs a lot of time to transcript the interview. Additionally, a disadvantage is that the interviewee might be uncomfortable when confidential or sensitive information is discussed (Walsham, 1995). An alternative for recording is extensive note-taking during the interview (Burnard, 1991; Walsham, 1995). However, during note taking only partial parts of the discussion can be noted and the attention of the interviewer is at taking notes instead of the interview. Therefore, a hybrid-approach will be used during the data collection. When the interviewee approves, the interview is recorded and in addition, several notes are taken, to underline the important parts of the interview.

The number of interviewees of officers from the internal department from organizations needed for the validity of this research is determined based on saturation sampling. Data saturation is reached when there is enough information about the study and additional information is no longer feasible (Fusch & Ness, 2015). The number of interviews on the point when data saturation is reached varies by author. For example, Morse (1994) argues that it is between 30 to 50 interviews, Hennink, Kaiser and Marconi (2016) state between 16 to 24 interviews. Whereas, Fusch and Ness (2015) and Patton (1990) point out that there is no single number when data saturation is reached. So, there is no one-size-fits-all. Therefore, this research will not apply a specified number of interviews. Interviews are conducting until additional interviews provide no supplementary information, in other words, saturation sampling. To conclude, interviews will be the primary source of the collection of practical data. The interviews will be conducted with EY experts and officers from the internal audit department from organizations. The number of interviews is based on saturation sampling.

13 Data analysis

The aim of the data analysis is to produce a systematic recording of the themes and issues addressed in the interviews. Additionally, data analysis aims to link the themes and interviews together under a category system, to make textual data logic (Basit, 2003; Burnard, 1991). Data analysis is found to be a crucial and difficult part of qualitative research, due to the complexity of the data. As mentioned in the data collection, the data is collected by means of interviews. Nevertheless, raw data does not facilitate the researcher to analyze the categories and relationships concerning the themes and issues addressed in the interviews. Therefore, the interview data is coded to make textual data logic, to analyze the data.

There are several ways of coding qualitative data. According to Drisko (2005), it is important to illustrate in detail how codes were formulated to help establish the credibility and validity of the research. Jones (2007) describes qualitative data coding as a process in which several textual segments are taken from their source and are tagged with a description, a code, for later comparison.

Firstly, there must be decided whether the data will be coded manual or electronic. Manual coding is a process which is done by hand, for example by highlighting text in different colours. Basit (2003) describes manual coding as a slow process of searching and filling. In contrast is electronic coding, which is an automated process with the use of software programs (Burnard, 1991). Electronic coding is a rapid and comprehensive way of coding and makes the process of coding smoother and less time-consumable. Nevertheless, electronic coding is only time efficient when large samples of raw data will be coded. Due to the fact, the software needs to be programmed depending on the research. In the context of this research, it is more time efficient to manually code interview data.

Secondly, there must be decided whether the codes are created on an inductive or deductive approach. Deductive coding means that the codes are created from a theoretical framework and inductive coding means that the codes are created depending on the interview data (Fereday & Muir-Cochrane, 2006). In the context of this research, there is no literature available for deductive coding. Therefore, the inductive coding approach is applied in this research.

Furthermore, Corbin and Strauss (1990) point out a three-level method of inductive coding. The first level is open coding, which means that each transcript is reviewed line-by-line and initial codes are created. Open codes are like notes and headings which are written in the text while reading it (Elo & Kyngäs, 2008). Subsequently, the second level is axial coding, in which the codes derived from open coding, are put together in broader categories. Burnard (1991) points out that these categories can be developed freely. Finally, the third level is selective coding, in which the main categories of interest of the research are selected. In order to organize the themes for the results, in higher orders (Elo & Kyngäs, 2008). To conclude, the overall coding process of this research is visualized, refer to figure 14.

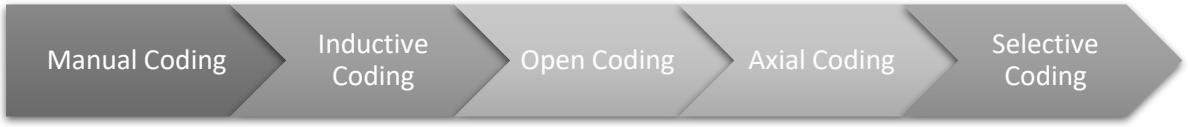

Figure 14 Coding process

IV Practical Findings

This part describes the practical findings regarding this research. This part contains the results of the data collection and data analysis, which is described in the research methodology. Firstly, the data regarding the practical findings are described. Secondly, continuous auditing is described from a practical perspective. Secondly, is described how the implementation process of continuous auditing can be facilitated. Finally, is described how the degree of adoption of continuous auditing in practice can increase.

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14 Data

In order to provide practical findings, data is collected by organizations and experts of EY, by means of interviews. Furthermore, in some cases, additional documentation is provided related to continuous auditing. The data is analyzed, in order to provide practical findings regarding this research. The objective of the data collection and data analysis is to provide practical findings in relation to the sub-questions, refer to chapter 3 for an explanation of these sub-questions:

- What is continuous auditing from a practical perspective?
- Why is the degree of adoption of continuous auditing low?
- How can the implementation process of continuous auditing be facilitated?

14.1 Data collection

In chapter 12 is described how data is collected regarding this research, in this chapter is described what the results are regarding the data collection. There is a distinction made between the data collected from organizations, and data collected from EY experts.

- Organizations

Firstly, the general sample consists of client organizations of EY. Additionally, this sample is extended by organizations from the personal network of the employees of EY. Secondly, this general sample is divided according to the maturity level described in the research methodology, refer to figure 13 in chapter 12.1.

There are several organizations selected, in order to conduct interviews with regarding continuous auditing. These organizations are classified as maturity level three and four. However, as noted in the research methodology, several experts of EY point out that it could be difficult to find organizations in maturity level five. After comprehensive research and discussions among EY experts, not a single organization is classified as 'level five' mature, or in other words, not a single organization in this selected data sample has an integral implementation continuous auditing which is a noticeably finding. Furthermore, continuous auditing is still not utilized by most of the organizations in the selected data sample of EY.

The organizations which cooperated with this research are all Dutch organizations and are client organizations of EY, or are familiar with EY via the (personal) network of the employees of EY. The organizational information and personal information are all anonymized in order the ensure the privacy and confidentiality of the data. However, in order to put research in perspective, a description of the organizations is provided, refer to table 5. These different backgrounds provided different perspectives regarding continuous auditing. Furthermore, the organizations are classified according to the characteristics of the maturity level, refer to figure 13 of chapter 12.1.

Anonymous name	Sector	Level of maturity
Organization A	Education	4
Organization B	Industry	3
Organization C	Tech	4
Organization D	Government & administration	4
Organization E	Financial services	3

Table 5 Organizations data collection

Organizations A, C, and D have implemented continuous auditing to a certain extent, on specific business processes. For example, organization A has implemented continuous auditing on the procurement process. Organizations B and E are familiar with the concept of continuous auditing. However, have not implemented continuous auditing to a certain extent.

- Experts

The data is collected via experts of EY, by means of interviews. These interviews provide rich insights regarding continuous auditing. Because these experts have both literature and practical knowledge regarding continuous auditing. The background of these continuous auditing experts also differs, which provided different perspectives, refer to table 6. Furthermore, these experts have provided additional documentation regarding continuous auditing, which is analyzed and consulted during this research.

Anonymous name	Department
Expert A	Financial IT-audit
Expert B	Data & Technology
Expert C	Innovation
Expert D	Financial audit
Expert E	Financial IT-audit

Table 6 Experts data collection

14.2 Data analysis

The collected data consist mostly of interview transcripts, all interviewees accepted to record the interviews. Which allows to transcript the interviews afterward in a detailed format. This detailed information provided the input for the data analysis. The data is analyzed and coded by a predefined coding process, refer to chapter 13. Additionally, documentation is provided by experts, which is also analyzed and consulted.

The coding process is a comprehensive data analysis method which enabled to demonstrate the differences and similarities in the data between the organizations and experts. Coding the raw data with inductive codes provided the first overview of the data. However, these inductive codes did not provide the necessary information to demonstrate the differences and similarities in the data. Therefore, the data is categorized in broader categories by means of axial coding. This provided insights regarding the differences and similarities in the data. Nevertheless, axial coding did not structure the data. Therefore, the axial codes are selected and categorized by means of selective coding. The main categories of interest are in this case the research sub-questions. Hence, this comprehensive data analysis method enabled to firstly demonstrate the differences and similarities in the data, and subsequently to structure the data.

Overall, it was not a complicated data analysis to conduct. Due to the fact, there were several similarities in the data. Nevertheless, each organization and expert provided additional insights and information, due to the different perspectives and backgrounds. These additional insights and information extended the data. However, there was a lot of overlap in the information provided, therefore the saturation point described in chapter 12.2 is reached to a certain extent. Furthermore, there were not many contradictions in the data, which needed to be clarified. In order to provide an overview of the data analysis, refer to Appendix F.

14.3 Response from interviews

First interviews are conducted with the experts, in order to clarify the concept of continuous auditing in practice and related topics. This information provided background information before interviewing organizations. The interview responses differ per organization, due to the applied qualitative research method. The semi-structured and open-ended interviews enabled to obtain an understanding of the practical attitudes towards continuous auditing, without an over-direction of the interview. This resulted in various information from the interviewee responses.

The content of the semi-structured open-ended interview framework is based on several sources. To ensure the validity and reliability of the interview questions, the interview was piloted with a college of EY to ensure the provision of useful research data. So, several sources are consulted and combined to arrive at a comprehensive interview guide for continuous auditing. However, in practice, additional subjects were discussed, which provided additional insights regarding this research. In order to provide an overview to what extent each interviewee is involved per subject, refer to appendix G. A summary of appendix G is provided in table 7.

Interviewees Organization -> Topics:	A	B	C	D	E	Experts
Sub-question 1: 'Continuous auditing'						
Developments in the internal process	■	■	■	■	■	■
Continuous auditing in practice	■	■	■	■	■	■
Interrelationship continuous- auditing, monitoring, and assurance	■	■	■	■	■	■
Sub-question 2: 'Implementation'						
Key elements of continuous auditing	■		■	■		■
Continuous auditing tool	■		■	■	■	■
Implementation of continuous auditing	■		■	■		
Sub-question 3: 'Increase adoption of continuous auditing'						
Importance of utilizing continuous auditing	■	■	■	■	■	■
Preconditions continuous auditing	■		■	■		
Benefits continuous auditing	■		■	■	■	

Table 7 Summary interview response

■ = Input per topic
■ = No input per topic

14.4 Reflection interview response

Furthermore, appendix G and table 7 demonstrate that there is a distinction to what extent each organization provided information. There are differences into what extent organization with a maturity level 3 and maturity level 4 provided information regarding continuous auditing. Furthermore, there is a difference to what extent experts provided insights regarding continuous auditing in relation to the organizations regarding continuous auditing.

- Maturity level 3

Organization B and E (maturity level 3) provided generic information regarding continuous auditing. Due to the fact, these organizations are familiar with continuous auditing, while these organizations have not implemented it. Therefore, these organizations were capable to provide information related to sub-question 1, which is the concept of continuous auditing.

However, these organizations were not capable to provide information related to sub-question 2, which is the implementation of continuous auditing. Because these organizations have not experienced the implementation process of continuous auditing. With the exception of organization E, which provided additional information related to a continuous auditing tool.

Furthermore, organization B and E were not capable to (fully) provide information related to the adaption of continuous auditing. Organization B and E provided insights that there are also alternatives for continuous auditing, for the innovation of the internal audit. So, organization B and E provided insights regarding continuous auditing and especially, why these organizations are not (yet) implementing continuous auditing.

- Maturity level 4

Organizations A, C, and D (maturity level 4) were able to provide more detailed information regarding continuous auditing. Due to the fact, these organizations have implemented continuous auditing, to a certain extent. Therefore, these organizations were capable to provide information related to sub-question 1,2, and 3. Organization A, C, and D provided similar information as organization B and E, related to the concept of continuous auditing.

Additionally, organization A, C, and D were capable to provide information related to sub-question 2, which is the implementation process of continuous auditing. Organization C and D have experienced a similar process of implementing continuous auditing, while organization A utilized a different process of implementing continuous auditing, refer to chapter 16.3.

Furthermore, organization A, C, and D were capable to provide information related to sub-question 3, which is the increase of adoption of continuous auditing. However, input for the information differs. Due to the fact, it differs per organization to what extent the pre-conditions and the benefits of continuous auditing are applicable. So, organization A, C, and D provided insights regarding the concept, the implementation and the adoption of continuous auditing.

▸ Experts

The results of the expert interviewees are combined, due to the fact these experts were interviewed first, to provide background information of continuous auditing. Additionally, the experts provided internal documentation of EY related to the concept of continuous auditing. In order to prepare the researcher for interviews with organizations. Furthermore, the experts are consulted to validate the organizational interview information. The experts were capable to provide information related to sub-question 1, which is the concept of continuous auditing. Additionally, the experts provided information related to the importance of utilizing continuous auditing, key elements of continuous auditing, and the continuous auditing tool.

However, the experts were not capable to provide information related to the implementation and adoption of continuous auditing. Due to the fact, the experts are independent auditors of organizations. So, the experts provided valuable information in order to successfully collect and analyze data from the organizations. While the experts were not capable to provide practical information related to the implementation and adoption of continuous auditing.

To conclude, experts of EY provided background information of continuous auditing, in order to clarify the concept of continuous auditing in practice and related topics. Subsequently, in order to successfully collect and analyze organizational data. Organization B and E (maturity level 3) provided generic information regarding continuous auditing. Due to the fact, these organizations are familiar with continuous auditing, while these organizations have not implemented it. While organizations A, C, and D (maturity level 4) were able to provide additional information regarding the implementation and adoption of continuous auditing. Due to the fact, these organizations have implemented continuous auditing, to a certain extent, thereby have experienced the consequences of this. Hence, the experts and the organizations from both maturity levels (3 & 4) provided insights into the diverse field regarding the implementation and adoption of continuous auditing.

15 Sub-question 1: What is continuous auditing from a practical perspective?

The practical findings concerning continuous are described in this chapter. As mentioned in the theoretical background, continuous auditing provides several benefits. Nevertheless, the current state of literature lacks empirical evidence concerning the current state of continuous auditing in practice. Therefore, practical findings are collected and analyzed in order to provide an overview of continuous auditing from a practical perspective. Firstly, developments in the internal audit process are described. Secondly, the current state of continuous auditing in practice is described. Subsequently, the interrelationship between continuous auditing, monitoring and assurance are described. Finally, a sub-conclusion regarding this sub-chapter is described.

15.1 Developments in the internal audit process

First, all experts point out that is important to understand the developments in the internal audit, in order to understand continuous auditing from a practical perspective. Due to the fact, these officers actually implement and work with continuous auditing. However, not every organization, such as organization B, has implemented an internal audit department which is responsible for the internal audit process, due to the costs. This organization has allocated the internal audit process to other departments, for example, the financial department.

Experts describe the internal audit as a part of the so-called three lines of defence. The three lines of defence is a model in order to mitigate risks within the organization by mean of internal control.

- The first line is the process level, which is primarily responsible for maintaining effective internal control and applies the methods and techniques, developed by the second line of defence.
- The second line of defence consists of risk management & compliance. This line develops methods and techniques for internal control, and functions as a collective of 'architects' for the design of the structure, systems, and procedures necessary for the internal control.
- The third line of defence is the internal audit, which provides the top management with additional assurance about the quality of management and control. The third line is not directly responsible for the quality of being in control of the organization. Nevertheless, the internal audit is responsible for the extent to which it is able to analyze and make visible the inconsistencies in the design and operational effectiveness of the internal control.

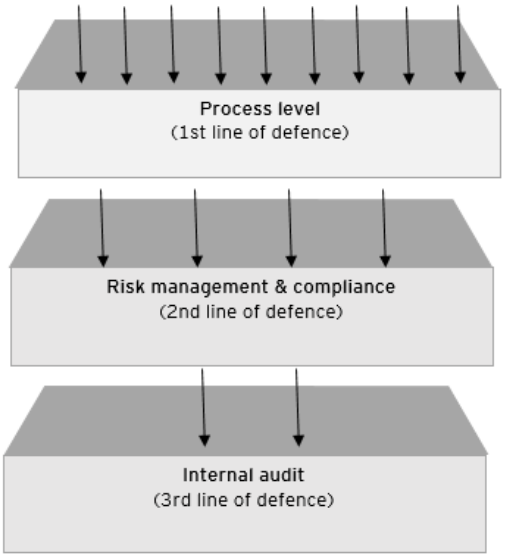

Figure 15 Three lines of defence; internal audit

In order to visualize the role of the internal audit in the three lines of defence model, refer to figure 14. The black arrows in figure 15 are possible errors/deviations in the organizational process. Which are mainly mitigated by the first line of defence, by means of applying the methods and techniques developed by the second line. As visualized, per line of defence the number of errors/deviations are decreasing. Exceptional errors/deviations, which are not corrected by the internal control, are for example corrected manually according to experts. Furthermore, the distinction between the first, second, and third line is not so obvious at each organization as described by experts. For example, at organization C and E, the second and third line are merged, or there is an overlap between these lines. So, the three lines of defence model is the principle concept of the internal audit process, although in practice the boundaries of this concept are fading.

Experts and organizations point out that there are several emerging trends and developments in the organizational environment, which also impact the role and function of the internal audit of organizations. These developments are combined and added up as;

- Organizations are managing evolving consumer expectations, new partnerships, dynamic ecosystems, changing industry boundaries, disruptive business models and new competitive domains.
- Every industry is changing and the cycles of change are moving faster.
- Industry convergence is touching every market segment.
- From technology and climate, to geopolitics and trade, the outside environment is changing.
- Operating models are shifting, employees seek purpose-driven organizations; full-time roles are being replaced by gig work; nature of work is changing due to technological developments.

However, not every trend and development has a direct or a significant impact on each organization in the data sample. Nevertheless, all these organizations in this data sample acknowledge one trend and development, which is that the industry in which they are operating is changing, and the cycles of change are moving faster. Therefore, organizations should adapt to these emerging trends and developments. For example, organization C point out that the internal control should improve and develop in the upcoming years, to follow up the ever fast changing organization.

Furthermore, organization B and experts imply that *'the internal audit should adopt a new risk lens, to define risks in a different way'*. Whereby, a distinction is made between several categories of risk. These different categories of risk entail that the organization should move from a risk avoidance attitude towards a risk optimization attitude, for better organizational outcomes. Striking the balance between mitigating negative outside and downside risks, and optimizing positive outside and upside risks require multifaceted approaches to the organizational *'organizations should reflect on their own portfolio of risk'*.

- Upside risks
  Risks that offer benefits. Risks significant to the organization's ability to execute its business strategy and achieve organizational objectives. For example, the potential for innovations to grow consumer bases, increasing market share, and acquiring, managing and deriving value from new assets and talent.

- Outside risks
  Risks that offer negative or positive benefits beyond the organization's control. For example, actions of existing and emerging competitors, geopolitical and economic megatrends, and demographic and environmental megatrends.

- Downside risks
  Risks that offer negative impacts. Risks an organization is focused on eliminating, avoiding, mitigating or transferring in a cost-effective manner. For example, information security and cybercrime, employee fraud and regulatory compliance, and enterprise resiliency - technology and business continuity.

Most of the internal audit approaches of the organizations in the data sample, are currently focussed on downside risks, in order to mitigate these risks by mean of internal control. Because several organizations point out that outside risks are impossible to mitigate by the development of internal control. While other organizations point out that by utilizing continuous monitoring and continuous auditing, several trends and developments could indicate signals of potential outside risks. For example, the repetitive increase of interest, or the repetitive decrease of turnover in a specific product and/or entity. However, to monitor outside risks is still in the development phase. For example, by machine learning, robotics, and business intelligence, according to experts and organization D.

Furthermore, organization B points out that upside risks are impossible to monitor and audit. Upside risks are potential business cases, which the management should decide to accept or mitigate, as organization B points out *'no-risk, no-fun, otherwise you cannot do business, organizations should be at risk to do business'*. Organization D and experts point out that the objective of the internal audit reporting is changing from, descriptive, towards predictive and prescriptive reporting, refer to figure 16[5]. The current audit approach of internal audit of the organizations is to descriptive report what happened, and what needs attention. Organization D and experts point out that the objective of reporting is changing to predictive and prescriptive reporting. However, this is a trend and development of the internal audit which is described by organization D and experts as *'predictive- and prescriptive reporting is the next step of development of internal audit'* . Due to the degree of difficulty, complexity to implement, or need for technology. Organizations in this data sample do not have the technology which enables these forms of reporting, and find the degree of difficulty, or complexity to implement to high. Organization D and experts describe examples of technologies utilized for predictive and prescriptive reporting as algorithms, machine learning, and robotics.

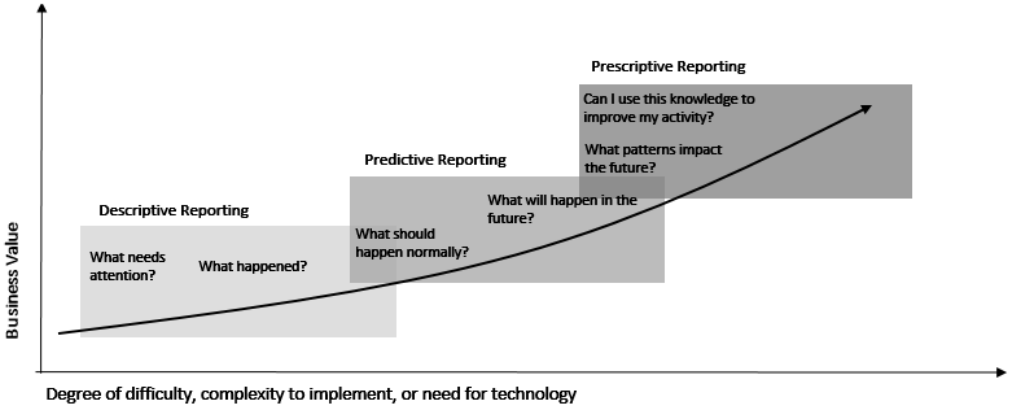

Figure 16 Descriptive, predictive, and prescriptive reporting internal audit

[5] https://find.ey.net/discover EY internal documentation

15.2 Continuous auditing in practice

Continuous auditing is a technological innovation in the internal audit, which facilitates the organizational demand for insights across the organization. Utilizing continuous auditing supports emerging developments and trends in the internal audit and organizational environment.

- **Global and local trends regarding continuous auditing**

In the past, EY has conducted several surveys among its client organizations, in order to assess the practical situation, trends, and developments in the internal audit. The EY global governance, risk and compliance (GRC) survey of 2015 indicated that 49% of the respondents utilize GRC technologies[6]. GRC technologies is an umbrella term for information technologies, including continuous auditing. However, the EY advancing analytics and automation within internal audit Survey 2017[7], indicated that organizations do not recognize themselves as mature organizations, who have implemented continuous auditing integral, or to a certain extent. This information has been translated into the internal control maturity model of this research, refer to figure 17. Nevertheless, organizations indicate that they do want to develop their maturity towards a mature level 4/5, or in other words, implement continuous auditing in the future. So, on the one hand, organizations do implement technologies within their internal audit and control processes, and on the other hand, organizations are not yet mature enough to categorize themselves as an organization with a continuous auditing environment.

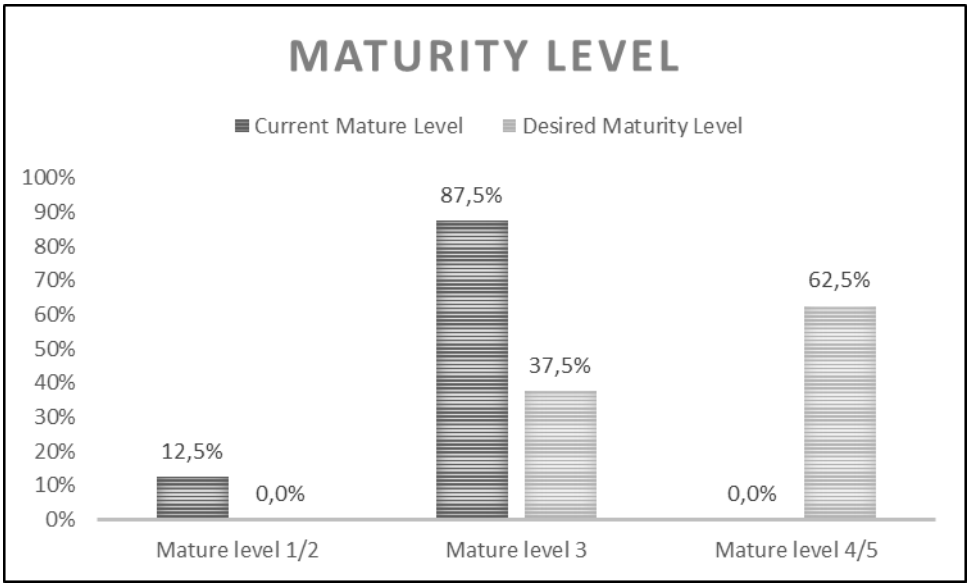

Figure 17 Mature level clients EY

These global findings are also confirmed by the organizations regarding this research. Organizations do improve their internal control by utilizing so-called GRC technologies within the organization. Due to the fact, these organizations acknowledge several emerging trends and developments in the organizational environment, which also impact the role and function of the internal audit of organizations. However, implementing continuous auditing described by organization B and E as *'implement continuous auditing is still a point far on the horizon, at the moment'* . Organizations A, C, and D point out that an integral implementation of continuous auditing is far away. Nevertheless, organizations are implementing continuous auditing on selective business processes, or are conducting pilots within the organization. So, the global trends related to continuous auditing are similar with the organizations regarding this research.

[6] EY Global governance, risk and compliance survey 2015

[7] EY Advancing analytics and automation within internal audit Survey 2017

- **The concept of continuous auditing**

All organizations in the selected data sample do not categorize themselves as mature organizations, who have implemented continuous auditing integral, or in other words an internal control maturity level of 5. Nevertheless, the organizations in this data sample are familiar with the concept or even have implemented it to a certain extent.

However, in the data sample regarding this research, there is no general interpretation of the concept of continuous auditing. The interpretation of 'continuous' varies from organization to organization. For example, daily, weekly, monthly, or quarterly. It depends on the organizational capabilities to complete the audit cycle. Nevertheless, the objectives of continuous auditing are similar, especially to improve the quality and effectivity of the audit and business processes. Furthermore, organization C describes the objective of continuous auditing as *'the objective of continuous auditing is to follow the speed of the organization which is changing rapidly'*.

Internally, experts use the following definition of the concept of continuous auditing; Continuous auditing is an audit approach performed by the internal audit to conduct effective integrated auditing and monitoring by utilizing technology to continuously gather data from the operational processes and management information systems. The timing of the audits is to report events continuous by providing 100% coverage. This concept of continuous auditing also helps to provide opinions on control breakdowns and changes. This definition of continuous auditing is utilized for internal documentation, and is utilized for informative learnings about continuous auditing.

- **Continuous auditing Framework**

Continuous auditing consists of four phases, per phase a description is provided in order to develop a framework of continuous auditing. This framework provides an overview of what continuous auditing is from a practical perspective. All organizations point out that continuous auditing is an audit approach to data processing. However, this is a catch-all term, therefore the data processing is subdivided into four phases, in order to clarify the process of continuous auditing and to provide a framework of continuous auditing.

- Phase 1: Data acquisition

The first phase of continuous auditing is the data acquisition process, from the operational processes through management information systems and applications. Therefore, internal auditors should understand and identify the data required for the audit. Experts described this process as the scoping of the audit, which can be very different for each organization. For example, organization A selected business processes to which continuous auditing can feasibly be applied. While organization C conducted risk assessments. Each organization describe that data acquisition plays a crucial role in continuous auditing because data enables continuous auditing. Furthermore, organization D points out it is import to obtain the data via a secured mechanism in a secure environment, to avoid any cyber or security risks. For example, organization A developed a tool which extracts data automatically, while organization D acquired a certified tool which extracts data automatically. It is organization dependent whether automatic tools are utilized, or extractions are conducted manually and periodically by means of queries, due to the costs.

- Phase 2: Data extraction, transformation, and loading

The second phase of continuous auditing is the data extraction, transformation and loading process. The data acquired for the audit is extracted from several different sources. For example, experts point out that it is very common that an organization have implemented several management information systems and applications for business processes. The process of data extraction differs per organization, several organizations could extract data manually, by means of queries. While other organizations have developed an extraction tool, which enables to extract data on command or continuous.

The output of this data extraction process are data files, these data files could have different file types and content types. Therefore, these data files should be transformed into an uniformly format, to mitigate the risk of errors/deviations. Furthermore, this data should be assessed on quality, or in other words data validation. The criteria by which organizations assess the data vary. For example, organization A and C validate the data on; completeness, accuracy, and timeliness. While organization D additionally validate the data on consistency, for example, to assess significant differences in the size and/or content of the data. Finally, the data can be uploaded into the continuous auditing data store and processing tool. It is possible to extract, transformed and load data by means of certified tools, according to organization D. In order to visualize phase 2, refer to figure 18.

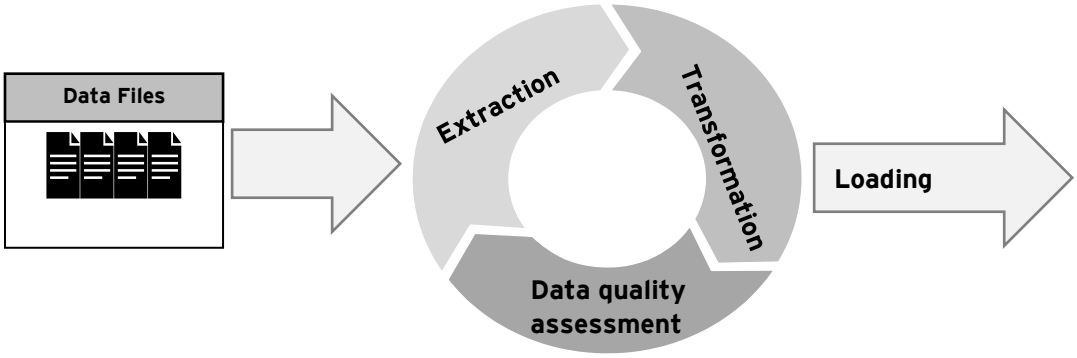

Figure 18 Phase 2 data extraction, transformation, and loading

- Phase 3: Data analysis

The third phase of continuous auditing is data processing. The extracted and transformed data is uploaded in the data store and/or continuous auditing tool, in order to conduct data analysis. The content of continuous auditing tool is described in chapter 16.2. The content of the data analysis in the continuous auditing tools depends on the objective of the internal audit, or in other words the scoping of the audit, discussed in phase 1. Organization D describes the aim of the data analysis as to visualize and report the findings. According to organization A, the data analysis is a very technical process, consisting of automated tools which communicate continuously. Therefore, it is mostly conducted by employees with IT and data analytics expertise.

- **Phase 4: Continuous auditing reports**

The fourth phase of continuous auditing is reporting. After the data acquisition is established, the data is extracted, transformed and uploaded in the data store and/or continuous audit tool, the data is analyzed. The results of these data analysis are continuous auditing reports. These reports consist of an overview of business processes, for example, by means of a dashboard. It depends on the scoping of the audit of the internal audit, what will be reported. For example, organization D report a total overview of the business process, while other organization A only report errors of the business process. These reports could be communicated with the stakeholders of the business processes. For example, with the first or second line of defense, or with the management.

In order to visualize the four phases of the concept of continuous auditing, refer to figure 19. The continuous auditing framework is an overview based on all the provided practical information regarding continuous auditing, received from interviews with organizations and experts. Important to notice is that organizations follow the same sequence of phases. While not every organization have reached each phase. Especially, phase 4 continuous auditing reporting and the communication of these results is a difficult phase for organizations, due to its complexity. For example, organization A point out *'not all colleagues do acknowledge the possible added value of the continuous auditing results'*. Therefore, communication of the objectives of continuous auditing is important.

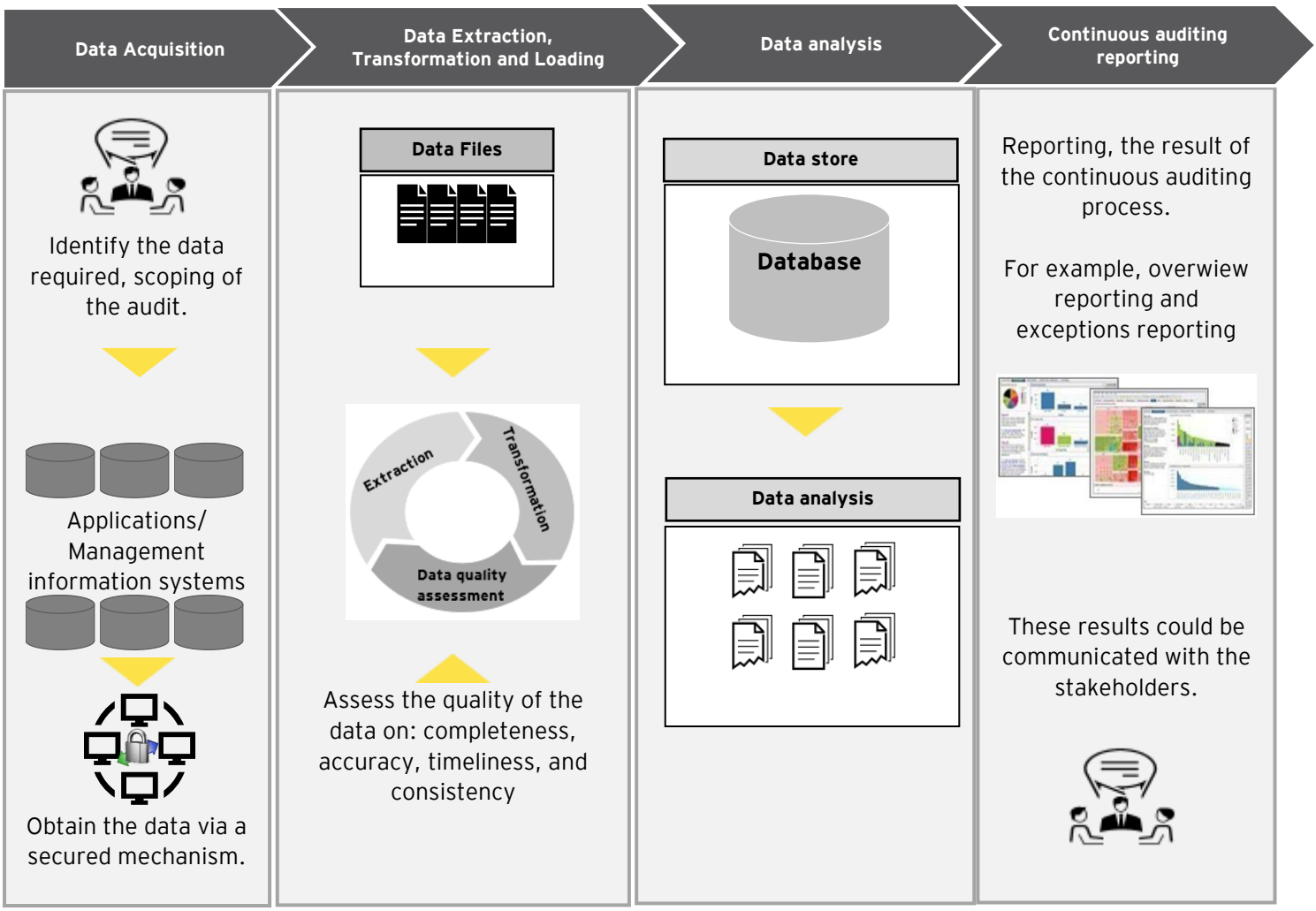

Figure 19 Continuous auditing framework

15.3 Interrelationship continuous - auditing, assurance, and monitoring

In order to describe the interrelationship between continuous – auditing, assurance, and monitoring, the three line model of defense is consulted and extended with the interrelationship of these concepts, refer to figure 20.

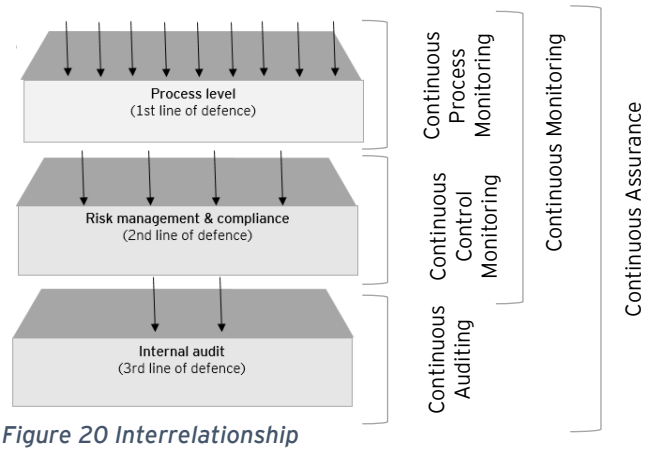

Figure 20 Interrelationship

- Continuous monitoring

  The concept of continuous monitoring can be subdivided into continuous process monitoring and continuous control monitoring. Organization C describes continuous process monitoring as the first line of defence, it consists of monitoring the business processes, to optimize the business process, and reduce related risks. For example, by means of end-to-end process performance, or key performance indicators (KPI). Continuous control monitoring is the second line of defense, it consists of confirming control effectiveness, to improve the efficiency of the internal control and risk management.

  All organizations acknowledge the difference between these two concepts of continuous process and controls monitoring. However, in practice, it is identified as one similar concept. Organizations describe the concept of continuous monitoring as a mechanism which can examine 100% of transactions across multiple applications and databases and identify, quantify and report on internal control failures. Examples of the internal control failures are; duplicate payments or transactions that fall outside of approved parameters. Organization A and C indicate a by-product of continuous monitoring, which is that it highlights opportunities to improve operational processes.

- Continuous auditing

  The concept of continuous auditing is the second or third line of defense, which depends on the organizational design of the internal audit, which consists of the identification of internal control failures. Organization D points out that continuous auditing is 'build' upon the foundation of continuous monitoring. Due to the fact, all organizations acknowledge that without continuous monitoring of the business processes and internal control, it is impossible to continuous audit of these business processes and controls. So, continuous auditing is an extension to the concept of continuous monitoring to test the design and operational effectiveness of the internal control. Furthermore, continuous auditing is described by organization D as *' continuous auditing is the continuous monitor of continuous monitoring'*. So, it is an extension which continuous audit the design and operational effectiveness of continuous monitoring.

- Continuous assurance
  Continuous assurance is the cross-cutting concept within the organization, which is facilitated by the concept of continuous monitoring and continuous auditing. Which is considered by experts and organizations, as a development for the upcoming years or even decades. So, not an organization in this data sample is utilizing continuous assurance. Organization D describes continuous assurance as *'continuous assurance is just formal signature for the external environment, internal management is not interest in such a formality'* of the design and operational effectiveness of the design and operational effectiveness of the internal control by an external audit. Organizations A,C, and E acknowledge the underlying rationale of continuous assurance. However, these organizations do not acknowledge the need or the importance, in order to provide continuous assurance. For example, organization C point out that *'continuous assurance is a nice addition however not the current objective'*. While organizations B and D do not acknowledge the underlying rationale of continuous assurance. So, not every organization recognizes the value of continuous assurance or have a demand for continuous assurance.

The described concepts above are interrelated, the similarity between these concepts is that these concepts are all continuous. Organization C described the interrelationship as *'continuous monitoring, auditing and assurance, one is not possible apart from the other, these concepts support each other'*. Furthermore, organization D points out that the borders between these different concepts are fading. According to organization B and E, these boundaries between these different concepts make it difficult for organizations to actually take up, and utilize these concepts. Because in this way it is placed in separate boxes, while these concepts are not so separate. Hence, the interrelationship between continuous- auditing, monitoring, and assurance is strong. However, the fading boundaries may clarify the interrelationship of these concepts. To conclude, it starts with continuous monitoring which is the foundation of continuous auditing, and continuous auditing enables continuous assurance.

15.4 Discussion sub-question 1

To arrive at the sub-conclusion conclusion regarding sub-question 1, theoretical and practical findings are compared, which will result in an overview of similarities and contradictories in theory and practice. The chapter is subdivided into three parts; developments in the internal audit process, the concept of continuous auditing, and the interrelationship between continuous- auditing, assurance, and monitoring.

- Developments in the internal audit process

  The internal audit is a department or process which evaluates and tests the design, and operational effectiveness of the internal control which is embedded within the organization (Doy et al., 2007; Krishnan, 2005). Additionally, practical findings demonstrate that the internal audit is part of the so-called three lines of defence. However, the distinction between the first, second, and third line is not so obvious at each organization.

  There are several developments in the organizational environment, which also impact the role and function of the internal audit and the internal audit process. Therefore, organizations should adapt to these emerging trends and developments. Kogan et al. (1999) argue that these developments are fueling the demand for continuous assurance. However, in practice, there is no demand for continuous assurance. While in practice, the demand for continuous auditing is fueled by the improvement and innovation of the internal audit. Due to the fact, the current internal audit is not able to cover the risks in the future. Furthermore, practical findings indicate that these developments are fueling a changing attitude towards risks. Which implies that the internal audit should adopt a *'new risk lens'*. Striking the balance between mitigating negative outside and downside risks, and optimizing positive outside and upside risks require multifaceted approaches to the organizational *'portfolio of risk'*. Furthermore, the objective of the internal audit reporting is changing from, descriptive, towards predictive and prescriptive reporting. Organizations do improve their internal control by utilizing so-called GRC technologies within the organization. However, implementing continuous auditing described in this research is *'still a point far on the horizon'*.

- The concept of continuous auditing

  There are differences and similarities between the theoretical- and practical definition of continuous auditing. Research and development of the concept of continuous auditing started almost 30 years ago. Alles et al. (2008) point out that continuous auditing is one of the rare instances in which innovation in accounting practice has been developed and driven by the academic community, as opposed to the usual model in which researched use data to investigate practices in a particular field.

  However, the practical definition is more comprehensive than the theoretical definition. Furthermore, the theoretical definition describes that continuous auditing enables continuous assurance, while in practice there is no demand for continuous assurance. As a result, the practical definition is more in line with the findings in this research, which will be consulted during the research as the definition of continuous auditing, refer to table 8.

Theoretical definition	Practical definition
'Continuous auditing is a concept to bring the audit process closer to the operational process. By utilizing technology to the maximum possible degree of audit automation. Which enables auditors to provide continuous assurance on a specific subject and to reduce audit costs.'	*'The concept of continuous auditing is an audit approach performed by the internal audit to conduct effective integrated auditing and monitoring by utilizing technology to continuously gather data from the operational processes and management information systems. The timing of the audits is to report events continuous by providing 100% coverage. This concept of continuous auditing also helps to provide opinions on control breakdowns and changes.'*

Table 8 Definition of continuous auditing

The theoretical definition describes the objective of continuous auditing as to provide continuous assurance and to reduce audit costs. While the practical definition describes the objective of continuous auditing is to report event continuous auditing by providing 100% coverage. The practical definition contains additional information regarding the objective and approach of continuous auditing, related to the theoretical definition. So, the practical definition is more comprehensive than the theoretical definition.

In theory, continuous auditing is described as a process of formalizing and standardizing; audit procedures, data, and internal control (Alles et al., 2006; Alles et al., 2008; Chan & Vasarhelyi, 2011; Chiu et al., 2014; Vasarhelyi et al., 2004). However, practical findings provided a more comprehensive in-depth insight regarding continuous auditing. Which led to the development of the continuous auditing framework. The continuous auditing framework consists of four phases, which are described and visualized in the continuous auditing framework. The four phases consist of; data acquisition, data extraction, transformation and loading, data analyzing, and continuous auditing reporting. The continuous auditing framework is an overview based on all the provided practical information regarding continuous auditing, received from interviews with organizations and experts.

- Interrelationship continuous - auditing, assurance, and monitoring

There are several concepts related to the concept of continuous auditing; continuous monitoring and continuous assurance. There are certain similarities between these concepts, nevertheless, these terms are not the same, but these terms are related (Alles et al., 2006). In the literature, there is a clear distinction made between these interrelated concepts. Continuous auditing and continuous monitoring enable and support each other, while continuous assurance is the objective of these concepts (Vasarhelyi et al., 2012). However, in practice, the boundaries between these interrelated concepts are beginning to blend together. Especially, continuous monitoring and continuous auditing are interpreted and utilized as one concept, due to the fact continuous auditing is an extension of continuous monitoring. Thus, in practice, it is identified as one similar concept. Continuous auditing is an extension to the concept of continuous monitoring to test the design and operational effectiveness of internal control, continuous auditing is 'build' upon the foundation of continuous monitoring

Furthermore, in theory, continuous assurance is described as one of the objectives of continuous auditing (Chan & Vasarhelyi, 2011). However, in practice, continuous assurance is defined as *'formal signature'* from an external audit, and at the moment there is no demand for continuous assurance in practice. So, the theoretical development did not correspondent with the practical utilization of continuous auditing.

15.5 Conclusion sub-question 1

The objective of this sub-question is to provide an overview of continuous auditing from a practical perspective, to answer the sub-question 1: '*What is continuous auditing from a practical perspective?'*.

There are several emerging trends and developments in the organizational environment, which also impact the role and function of the internal audit of organizations. Utilizing continuous auditing supports these emerging developments and trends in the internal audit and organizational environment.

Nevertheless, there is no clarified understanding of the concept of continuous auditing. Due to the fact, there are several interrelated concepts with continuous auditing, such as continuous monitoring and continuous assurance. In the past, a clear distinction was made between these concepts, as a consequence that organizations no longer saw any merit in all the different concepts that are interrelated, and built upon each other. The boundaries between these concepts make it difficult for organizations to understand and utilize these concepts. However, the boundaries between these interrelated concepts are beginning to blend together. In order to understand the concept of continuous auditing, it is defined as followed:

'Continuous auditing is considered as an audit approach performed by the internal audit to conduct effective integrated auditing and monitoring by utilizing technology to continuously gather data from the operational processes and management information systems. The timing of the audits is to report events continuous by providing 100% coverage'.

Additionally, to provide an overview of continuous auditing from a practical perspective, there is a continuous auditing framework developed, refer to figure 19, chapter 15.2. This continuous auditing framework consists of four phases of continuous auditing.

16 Sub-question 2: How can the implementation process of continuous auditing be facilitated?

The practical findings concerning the implementation of continuous are described in this chapter. The acceptance and utilization of continuous auditing in practice is slow. Therefore, practical findings are collected and analyzed, to provide an overview how the implementation process of continuous auditing can be facilitated. Firstly, the key elements of the implementation of continuous auditing are described. Secondly, the capabilities of a continuous auditing are described. Thirdly, the process of implementation is described. Finally, a sub-conclusion regarding this sub-chapter is described.

16.1 Key elements of continuous auditing

Before describing how the implementation process of continuous auditing can be facilitated, it is important to have an overview of the related key elements. Organizations point out several important key elements who are involved in continuous auditing. The aggregate key elements who are involved in continuous auditing are; technology, people, process, and data.

- Technology

  A key element related to continuous auditing is technology. Continuous auditing is enabled by utilizing technology in the audit. It differs per organization in which technologies are utilized for continuous auditing. However, organization C point out *'it is important to utilize a technology which the people involved support, because these people make it or brake it'*, due to the fact, these people actually work and implement these technologies. Organizations acknowledge that technology should be chosen to support scalability and ease of utilization across the organization.

  Furthermore, organization A, C, and D describe continuous auditing as information technology (IT), so the organization of the IT-environment influences the implementation of continuous auditing. Organizations with a well-structured and straightforward organization of management information systems and applications in the IT-infrastructure are more capable to implement continuous auditing. Due to the fact, the design of the internal controls is more effective and efficient to implement.

- People

  A key element related to continuous auditing are the people. Despite, continuous auditing is an automated process which substitutes manual processes, it is designed and implemented by people. Therefore, the organization should acquire specific knowledge to implement continuous auditing, refer to chapter 17.2 for the type and combination of knowledge.

  Furthermore, designing and implementing continuous auditing is described by organization A as a *'continuous auditing is as the name a continuous process'*. Firstly, continuous auditing should be able to adapt to organizational changes, so the completion of the designing process depends on organizational changes. Secondly, *'continuous auditing is not implemented in just a moment, it is an extensive process which takes time'*, according to organization D. The implementation process is a complex process which requires human capital. Moreover, organization C point out that the abilities and mindset of the people involved in the implementation process of continuous auditing, determine to what extent continuous auditing is implemented successfully. So, the people's ability to design and implement continuous auditing and the changeability of the people are a key element regarding the implementation of continuous auditing.

- Process
  A key element related to continuous auditing is the process, which is described in twofold. Firstly, the business process on which continuous auditing is implemented (first and second line of defense, refer to chapter 15.1). These business processes should be normalized, in order to automate. Secondly, the continuous auditing process should be designed and implemented in such a way, that no manual actions are required, according to organization A, C, and D. Otherwise, it is not feasible to conduct continuous auditing on a business process.

- Data
  All organizations acknowledge that data plays a key role in continuous auditing. Organization D described data as *'data is the life-line of continuous auditing, without data continuous auditing cannot be realized'*, because data enables continuous auditing. Therefore, data will be used to drive insight and make critical business decisions. Data acquisition and quality will need to be assessed for effective continuous auditing outputs. Each organization acknowledges the importance of data validation. Otherwise, the continuous auditing reports are worthless. However, on the basis of which data is validated is different for each organization, refer to phase 2 of the continuous auditing framework chapter 15.2

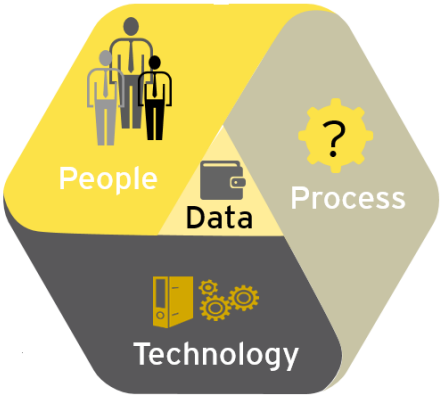

Figure 21 Key elements of continuous auditing

In order to visualize the key elements related to continuous auditing, refer to figure 21[8]. Data is central in the concept of continuous auditing, which organizations and experts acknowledges. Due to the fact, without data, there is no possibility to continuous audit a business process. The other key elements are; people, process, and technology, which are visualized in the surrounding area. These other key elements are interrelated. People determine which business processes will be continuously audited. Additionally, people and technology determine how these processes are continuously audited. Furthermore, people determine which technologies are utilized related to continuous auditing.

[8] https://find.ey.net/discover EY internal documentation

16.2 Continuous auditing tool

As described in chapter 15.2, the second phase of continuous auditing is the data extraction, transformation and loading process. Experts and organization E have described a continuous auditing tool, which consists of several toolsets and capabilities. However, it is organization dependent how this continuous auditing is utilized in practice and how it is implemented. The continuous audit tool does not have to be developed and implemented separately from the management information systems and/or applications. It is a possibility to implement the continuous auditing tool within the existing management information systems and/or applications. For example, organization A and D utilize continuous auditing tools separate from the management information systems and/or applications, while organization C has implemented within the existing management information system.

Despite the different architectures of a continuous auditing tool, an effective continuous auditing tool requires integrating and leveraging a variety of toolsets to achieve the needed capability. Experts point out that these toolsets can be subdivided in: data management, data integration, analytics and reporting, and automation. The capabilities of each toolset are described below, which highlights critical capabilities and components of a continuous auditing tool, refer to table 9.

Toolsets	Capabilities
Data Management 	▸ Ability to acquire data. ▸ Ability to verify the data. ▸ Ability to structure data. ▸ Ability to store data.
Data Integration 	▸ Ability to integrate data from different data sources and business processes for consistent use in tools. ▸ Ability to transform data into a uniformly format for analytical purposes.
Analytics and Reporting 	▸ Ability to conduct continuous analytics, based on the audit scoping. ▸ Ability to continuously create reports or active dashboards. ▸ Enhance the internal audit to conduct follow-up actions.
Automation 	▸ Ability to automate processes that require manual tasks. ▸ Enhance internal audit focus on mitigating risk via reduction of manually actions.

Table 9 Capabilities continuous auditing tool

Not every organization utilizes an *'overall continuous auditing tool'*, which consists of the described toolsets and capabilities. Organizations could utilize different tools which consist each a different toolset. For example, organization D utilizes certified tools for data management and data integration, while organization D develops its own analytics and reporting, and automation. Therefore, it is organizational dependent on how a continuous auditing is tool designed and implemented.

16.3 Implementation of continuous auditing

The implementation process of continuous auditing is a complex and large process. For example, organization D point out *'the implementation process of continuous auditing, is not as easy as one-two-three'*. Therefore, organizations start implementing continuous auditing in phases per business process, by means of so-called *'pilots'* or *'trials'* by organization A. Important to notice is that organizations who are implementing continuous auditing, are implementing it on the foundation of an already existing internal control. Not a single organization is starting implementing continuous auditing on a so-called *'zero-point'*, according to organization C. In order to implement continuous auditing, organizations should comply to several phases of the implementation process of continuous auditing.

- Planning
  Organization C and D point out that organizations should develop a planning regarding the implementation of continuous auditing. Due to the fact, the implementation process of continuous auditing requires human capital, time, and investments in technologies. Without a thoughtful planning, the implementation process of continuous auditing is going to be pointless.

- Risk assessment
  Organization C points out that organizations should assess their organizational business processes and the environment in order to identify risks. Thereafter, these risk assessments provide an overview, which enables to rank the risks and provides visibility into highest risks. These risk assessments are the foundation for the development of the continuous internal control framework.

- (Continuous) Internal control framework
  Organization C points out that after the risk assessment is conducted, the organization should develop an internal control framework to mitigate or accept these risks. While organization D points out that continuous auditing can be developed by means of the existing internal control framework. Organization C and D point out that this internal control framework provides an overview of all the internal controls. The internal control framework consists of two types of internal controls. Firstly, passive or detective internal controls, which is to determine afterward whether there are errors/deviations in the business process. Secondly, preventive internal controls, which is implementing controls which avoid a specific event can take place, examples of preventive controls are information technology general controls (ITGC) and application controls. This overview enables to identify which internal controls could and/or should be automated for continuous auditing, which enables the development of a continuous internal control framework.

- Automate business processes
  All organizations point out that business processes which require manual operations and processing do not allow continuous auditing. Therefore, the organization should assess which manual business processes can be automated. Because automated business processes enable continuous and real-time data, which is the life-line of continuous auditing, refer to chapter 16.1.

- Build a continuous auditing tool
  After is determined which internal controls and business process are audited continuous. The organization builds or acquires a continuous auditing tool. For a description of the toolsets and capabilities of such a continuous auditing tool, refer to chapter 16.2.

- Execute continuous auditing
  After the foundation for continuous auditing has been designed and implemented. Continuous auditing should be executed, in order to test if the continuous auditing process is designed and implemented appropriately according to the continuous auditing framework, refer to chapter 15.2.

- Review
  Organization C point out that after the implementation of continuous auditing is executed. The organization, including the internal auditors and management review and reflect the implementation process. to determine which phases of the implementation process requires improvement, to extend the scope of continuous auditing more effective and efficient. Furthermore, business processes and internal controls can change. Therefore, the implementation of continuous auditing should be reviewed periodically, to establish if the current design and implementation of continuous auditing are still effective.

However, not every organization is following a predefined process or procedure, in order to implement continuous auditing. For example, organization A started to establish which processes are obvious for continuous auditing, to start with pilots and experiments. It is a form of trial and error which request for so-called *'repair operations'* afterward. Therefore, organization A acknowledges it is plausible to adopt an implementation process. However, there is no *'good practice'* regarding the implementation of continuous auditing. Therefore, the implementation process of continuous auditing requires comprehensive designing into a continuously cycle. In order to visualize the implementation process of continuous auditing, refer to figure 22.

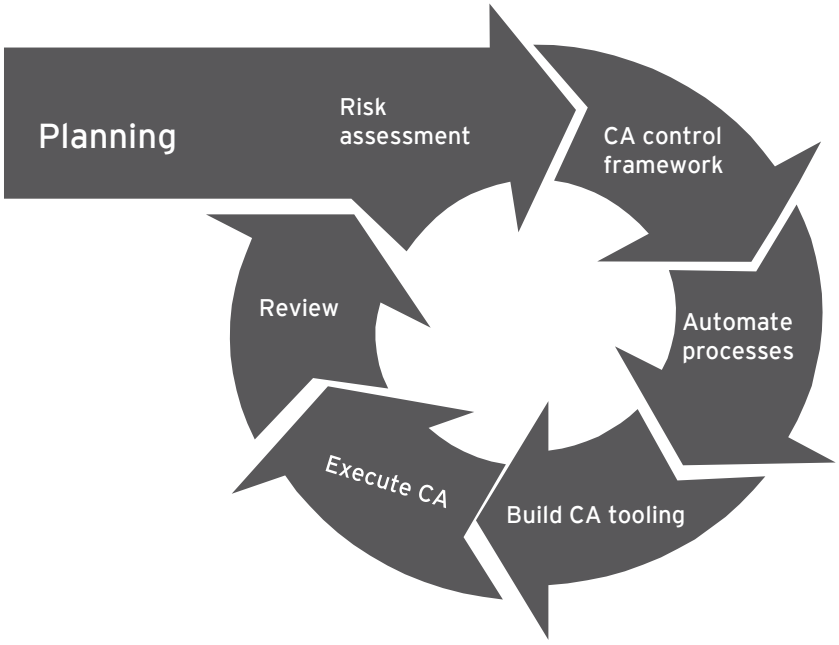

Figure 22 Implementation of continuous auditing

16.4 Discussion sub-question 2

To arrive at the sub-conclusion conclusion regarding sub-question 2, theoretical and practical findings are compared, which will result in an overview of similarities and contradictories in theory and practice. The chapter is subdivided into three parts; the key elements of continuous auditing, continuous auditing tool, and implementation of continuous auditing.

- Key elements of continuous auditing

  Practical findings provided the insight that there are several key elements related to continuous auditing; technology, people, process, and data. In the theory of continuous auditing, data is mentioned as the enabler of continuous auditing, and the organizational environment is becoming more data-intensive (Alles, Kogan, &, Vasarhelyi, 2008; Chan & Vasarhelyi, 2011). In practice, data is described as *'the life-line of continuous auditing'* because data enables continuous auditing. So data is a key element of continuous auditing.

  Additionally, continuous auditing is enabled by utilizing technology in the audit. There are several technologies available for continuous auditing which facilitate the implementation of continuous auditing (Brown et al., 2007). However, practical insights provided the insight that it is important to utilize a technology which the people involved support. Because these people actually work and implement these technologies. Organizations acknowledge that technology should be chosen to support scalability and ease of utilization across the organization. It differs per organization in which technologies are utilized for continuous auditing.

  In addition, a key element related to continuous auditing is people. Despite, continuous auditing is an automated process which substitutes manual processes, it is designed and implemented by people. The implementation process is a complex process which requires human capital. Human capital is discussed in the literature as a drawback for continuous auditing (Chiu et al., 2014; Vasarhelyi et al., 2012; Rezaee et al., 2002). However, the literature lacks additional insights into the importance of people in continuous auditing. Because the people's ability to design and implement continuous auditing and the changeability of the people are a key element regarding the implementation of continuous auditing. Furthermore, the process of continues auditing is a key element related to continuous auditing, which is discussed in chapter 15.4 '*The concept of continuous auditing'*.

- Continuous auditing tool

  In the theory are several architectures discussed related to a continuous auditing tool. Internal of the system by means of an EAM (Kuhn & Sutton, 2010). External of the system, by means of EAM ghosting, MCL, and Audit Data Warehouse (Kuhn & Sutton, 2010; Rezaee et al. 2002; Vasarhelyi et al., 2004). However, these forms of architectures do not provide insights related to the toolsets and capabilities of a continuous auditing tool. An effective continuous auditing tool requires integrating and leveraging a variety of toolsets to achieve the needed capability. Which consists of; data management, data integration, analytics and reporting, and automation. So the theoretical findings provided insight regarding the architectures of a continuous auditing tool, while the practical findings provided insight regarding the toolsets and capabilities of a continuous auditing tool. Hence, it is organizational dependent on how a continuous auditing tool designed and implemented

- Implementation of continuous auditing

  The implementation process of continuous auditing is a complex and large process. However, the current state of the literature lacks information and guidance for organizations to implement continuous auditing. There are two pilot implementations which are provided information regarding the implementation of continuous auditing (Alles et al., 2006; Alles et al., 2008). Pilots are also conducted in practice, in order to implement continuous auditing. Due to the fact, a pilot offers the opportunity, to implement continuous auditing on specific business processes, which enables the organization to learn from the pilot. By means of how to perform continuous auditing effectively and efficiently, and to demonstrate the value of continuous auditing internally.

  Furthermore, IT-implementation strategies may facilitate the implementation process of continuous auditing. There are two main streams in the literature concerning the implementation of IT; the waterfall approach and the agile approach. The waterfall approach is a plan-based method for implementing IT (Boehm, 1984). The waterfall approach is a stepwise process, consisting of several phases (Davis et al., 1988) . Which is similar to the implementation process developed based on the practical findings. In order to implement continuous auditing, organizations should comply to several phases of the implementation process of continuous auditing. The implementation process of continuous auditing requires comprehensive designing into a continuously cycle.

  Additionally, an implementation strategy of IT is the agile approach. The agile approach is a flexible implementation strategy which is characterized by early wins and rapid feedback and the accomplishment of small implementation steps (Highsmith & Cockburn, 2001; Williams & Cockburn, 2003). This approach is also utilized in practice. However, the specific organization utilized this kind of approach, acknowledged that a plan-based method is fitting the implementation of continuous auditing better. Due to the fact, of the so-called *'repair reparations'* which needed to be executed afterward to succeed the implementation of continuous auditing.

  In comparison to the two main streams, of IT related implementations in the literature; the waterfall- and agile approach. The implementation of continuous auditing is a hybrid approach to these streams. Due to the fact, the implementation of continuous auditing requires comprehensive planning (waterfall), because organizations acknowledge that there is no *'good practice',* regarding the implementation of continuous auditing in the literature. While continuous auditing is implemented on specific business processes, like 'small sprints' or 'milestones' (agile). So, the implementation of continuous auditing is organizational specific, which requires comprehensive planning and is implemented by means of pilots on specific business processes.

16.5 Conclusion sub-question 2

The objective of this sub-question is to provide an overview of how the implementation process of continuous auditing can be facilitated, to answer the sub-question 2: *'How can the implementation process of continuous auditing be facilitated?'*.

The implementation processes of continuous auditing can be facilitated by means of pilots or trials. Due to the fact, continuous auditing is a large and complex process, which is not implemented as easy as one-two-three. A pilot or trial offers the opportunity, to implement continuous auditing on specific business processes. Which enables the organization to learn of the pilot, by means of how to perform continuous auditing effectively and efficiently, and to demonstrate the value of continuous auditing internally.

Therefore, organizations should start with thoughtful planning regarding the implementation of continuous auditing. Organizations should take the key elements regarding continuous auditing into account; technology, people, process, and data. The combination of these key elements ensures that the implementation of continuous auditing can ultimately be successful.

The implementation process of continuous auditing requires comprehensive designing. Due to the fact, it is organizational specific, and there is no 'good practice' of a continuous auditing design and implementation process. Furthermore, the implementation process of continuous auditing should be reviewed after execution. Due to the fact, business processes and/or internal controls can change. Therefore, the implementation of continuous auditing should be able to adapt to these change, to mitigate the related risks. So, the process of implementation of continuous auditing is a continuous cycle.

17 Sub-question 3: How can the degree of adoption of continuous auditing increase in practice?

The practical findings concerning the adoption of continuous auditing are described in this chapter. Organizations historically have not experienced a huge benefit from adopting continuous auditing. However, with ongoing emerging risks and increased regulatory activity a clear vision of what this means, how to execute it, and to obtain the benefits from it is ever so important. Therefore, practical findings are collected and analyzed in order to provide an overview of how the degree of adoption of continuous auditing can increase in practice. Firstly, the importance of utilizing continuous auditing is described. Secondly, an overview of pre-conditions which an organization supposed to have, in order to adopt continuous auditing is discussed. Thirdly, the possible benefits of adoption continuous auditing are described. Finally, a sub-conclusion regarding this sub-chapter is described.

17.1 Importance of utilizing continuous auditing

There are several emerging trends and developments in the organizational environment, which also impact the role and function of the internal audit of organizations, refer to chapter 15.1. Organizations and experts acknowledge that business management should adapt to these trends and developments, in order to remain a sustainable organization. Experts describe this organizational adaption as change readiness and competencies to manage a new environment.

Organizations acknowledge that the current internal audit possesses the necessary competencies to fulfill the business management demand and cover the risks. However, experts point out that the internal audit is unable to fulfill the business management demand and to cover the risks with the emerging trends and developments, which will create a risk gap, refer to figure 23[9]. Therefore, the importance of improvement and innovation of the internal audit, by means of utilizing technologies is ever so important.

Experts and organization D point out that the importance of utilizing technologies in the internal audit, such as continuous auditing, is acknowledged in the United State of America (USA), which have embedded additional rules in the Sarbanes-Oxley compliance (SOX). Which leads to a clear business case that a publicly traded organization must comply with the internal control framework, by means of utilizing technologies. In the Netherlands, there are regulations related to the internal control, but no such compliance regulation, organizations in the data sample act on compliance principles. Exceptions are Dutch organizations who are owned by USA organizations. So, the USA utilizes a rule-based, and the Netherlands utilize a principle-based regarding utilizing technologies in the internal audit.

However, not every organization suggests that continuous auditing is the solution to the emerging trends and developments. For example, organization B and E point out *'continuous auditing is quite expensive related to the possible added value, therefore we are looking for alternative innovations in the internal audit'*. While other organizations acknowledge the importance and describe continuous auditing as the future of internal control. Especially, organizations A, C, and D, who have implemented continuous auditing to a certain extent, acknowledge the importance. So, organizations acknowledge the importance of innovation and improvement of the internal audit only there are still differences of opinion to what extent continuous auditing provides added value to the organization.

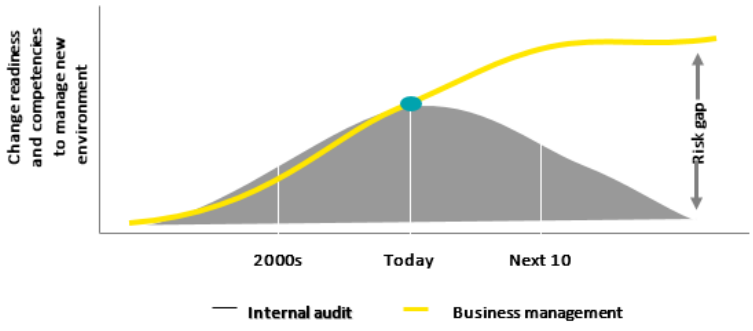

Figure 23 The importance of utilizing continuous auditing

[9] https://find.ey.net/discover EY internal documentation

17.2 Preconditions continuous auditing

Despite, the importance of utilizing continuous auditing within the organization, not every organization is capable to implement and adopt continuous auditing. Therefore, an organization should possess several pre-conditions, in order to adopt continuous auditing. It is important to note, that the described pre-conditions below are collected by means of interviews with organizations A, C, and D who have already implemented continuous auditing to a certain extent, and have experienced what important conditions are to successfully implement continuous auditing. The pre-conditions described below are not a list that an organization has to comply each to implement continuous auditing. It provides an overview of the collected pre-conditions, and it is organizational specific which pre-conditions are applicable and to what extent. Furthermore, organizations may see these pre-conditions as drawbacks, due to the complexity.

- Internal Control

  Not every organization is capable to implement continuous auditing within their organization. It depends on the so-called maturity of the internal control of the organization. Organization C and D point out that organizations who are implementing continuous auditing, *'an organization does not start implementing continuous auditing on zero-point, concerning the internal control, organizations already have embedded an internal control within the organization'*. An organization who intends to implement continuous auditing should at least have an internal control maturity level 3, refer to chapter 12.1. Maturity level 3 consists of organizations who have embedded an internal control, by means of a design of the internal control, and making it possible to verify its operational effectiveness. In other words, an effective internal control framework. Furthermore, not every organization conducts centralized internal audits. For example, organization D is structured in multiple entities, which conduct each their own internal audits. Organization D points out that centralization of these different internal audits is necessary, in order to continuous audit the entire organization.

  Additionally, organizations A, C, and D convert this internal control into a specified continuous control framework. To establish which internal controls should be conducted automatically and continuous, or as organization D described it as *'measure what you want to measure continuous, instead of measure what you need to measure'*. So, this continuous control framework provides an insight into what extent internal control is continuous.

- IT-environment

  Organization A, C, and D describe continuous auditing as information technology. Therefore, the internal control should be embedded within the management information systems or applications, from which the continuous auditing tool is receiving data. Otherwise, the outcomes of the continuous auditing reports are worthless. Therefore, are in information technology general controls (ITGC) and application controls embedded, in order to retain the organizational internal control. Furthermore, organization A point out that these ITGC's and application controls should be effective, in order to rely on the accuracy and completeness of the data. Additional, organization C point out that it has a positive influence the organization does not utilize a legacy IT-environment. Hence, a mature IT-environment is a pre-condition for continuous auditing.

- A low frequency of changes

  Organization C point out that a pre-condition for the implementation continuous auditing is that there is a low frequency of changes, regarding the internal control framework and application modifications. To maintain the coverage of the (continuous) internal control framework. Despite the low frequency of changes, organizations should be flexible to improve the organizational resilience. Because organizations should be able to adapt the (continuous) internal control framework to possible changes. Organization C described this as *'a contradictory fact because the environment is changing more rapidly while the internal framework should consist of a low frequency of changes.'* While *'there are always external developments and trends which impacts and changes business processes'*, according to organization D. So, this is a field of tension, which the organization should manage sufficient, in order to implement continuous auditing successfully.

- Automated processes

  Organization A, C, and D describe a pre-condition for implementing continuous auditing as that the processes should be automated. Therefore, manual processes should be normalized, in order to automate. Due to the fact, manual processes in the first, second or third line of defense, decelerate the process of data extraction, and thereafter the process continuous auditing. As organization C points out, *'Manual processes are the weakest link in the continuous auditing process, because they slow down the process'* and *'in a highly automated environment it is more straightforward to adopt continuous auditing*'. Hence, the business processes should be highly automated, in order to extract continuously data due to the decelerating effect of manual processes.

- Continuous monitoring

  As described in chapter 16.3, continuous auditing is an extension of the concept of continuous monitoring. Therefore, a pre-condition for utilizing continuous auditing is that continuous monitoring is already implemented. Organizations acknowledged that without the ability to continuously monitor processes and controls it is unfeasible to continuous audit. Due to the fact, continuous monitoring enables a continuous supply and access to data.

- Human Capital

  To implement continuous auditing, it requires specific knowledge. Especially, a combination of knowledge regarding audit, IT, and analytics according to organization A. Additionally, organization D points out that human capital regarding continuous auditing should include knowledge regarding the domain and business processes are necessary. This combination of knowledge is described by organization D as an *'this combination of knowledge is a-typical profile of a professional, which are not educated at schools or universities'*, or quoted as *'this combination of knowledge is like the five-legged sheep'*. Organization C and D have these combinations of knowledge at its disposal. However, not every organization has this combination of knowledge at its disposal. Therefore, organization A have attracted external knowledge, by means of hiring external advisory or consultancy.

  Organization D points out that it is not necessary for each employee to have this baggage of knowledge. It is also possible to compose a team with this different knowledge expertise. Nevertheless, this can lead to challenging situations, since an employee has expertise in one area must be able to move in the perspective of another area, this can lead to conflicts. So, employees have to be able to think/act from different perspectives. Hence, human capital is a crucial pre-condition for the implementation of continuous auditing.

- Budget

  An organization should provide a budget to realize the implementation of continuous auditing. Organization A points out that such a budget should consist of the ability to hire people with the appropriate knowledge, or investments in hardware and software. However, budgeting is not necessary for organization C and D. Due to the fact, organizations C and D have an innovative organizational culture, which naturally allows such innovate processes. As organization C describes it as *'everyone within this organization is working to automate and improve their own operations'*. At organization D employees are provided half a day to freely innovate and improve in relation to continuous auditing and other internal control improvements. So, a budget for hardware, software, and people is necessary to implement continuous auditing. However, how the budget is provided differs per organization.

- Changeability of the organization

  The implementation of continuous auditing is often restrained because employees and the management of organizations lack the ability to change. Due to the fact, the implementation of continuous auditing is often a huge and/or complex process. Therefore, the organization should have a driver to change and implement continuous auditing, so an intrinsic motivation.

  Firstly, organization A points out that the management of the organization should support the implementation of continuous auditing. Some organizations are given the freedom of the management, to pilot and experiment with the implementation of continuous auditing. While other organizations are accountable to the management for the progress of the implementation of continuous auditing.

  Secondly, organization C points out that the employees should support the implementation of continuous auditing. Otherwise, the employees are restraining the progress of the implementation of continuous auditing. Organization A points out that *'kick-off events'* and *'training on the job'* improve the changeability of the origination.

17.3 Benefits of continuous auditing

In the case, continuous auditing is implemented, integral or to a certain extent, it provides several benefits for the organization. The information of this benefits is collected by means of interviews with organization A, C, and D. Due to the fact, these organizations have an internal control maturity level 4, which have implemented continuous auditing successfully to a certain extent. Furthermore, organization E was aware of several benefits of continuous auditing. While organization B is not aware of the possible benefits of continuous auditing. Awareness of these benefits entails the motivation to implement continuous auditing and increase the degree of adoption of continuous auditing in practice. Therefore, these benefits are described, in order to provide an overview of the (possible) benefits of continuous auditing.

- Higher quality of business processes
  Organization A, C, and D point out that the quality of the business processes is improved by utilizing continuous auditing. Due to the possibility to detect or even prevent errors/deviations in the business processes. Which provides the organization insights in risk gaps in the business processes. Therefore, several organizations have redesigned business processes, to mitigate these risks. While other organizations have developed additional internal controls to these risk gaps. So, continuous auditing enables to provide insight into business processes and enables to adapt business processes or internal control to changes, which improves the quality.

- Higher quality of the audit
  Organization A, C, D, and E point out that the quality of audit is higher through utilizing of continuous auditing. Due to the fact, more audit coverage, 100% of the population can be audited instead of a sample. Furthermore, less manual errors, because audit processes are automated and normalized. Additionally, organization C point out that the processes of the audit are normalized, which reduces human interpretation. These human-related risks can simply be mitigated, by utilizing continuous auditing. So, continuous auditing enables increased coverage of the data and reduces manual risks.

- More efficient audit
  Organization C, D, and E point out that the audit process is more efficient by utilizing continuous auditing. Due to the fact, less time is required in testing of processes and controls. For example, organization D point out *'instead of having five employees performing the same controls for five different entities, it can be automated by means of continuous auditing'*. Additionally, it enables increased productivity for the internal audit, due to the possibility employees can extend or improve their audit process. However, each organization finds it difficult to demonstrate in statistics the more efficient the audit is, while the invested time and money is less difficult to demonstrate to the management.

- More effective audit
  Organization A and C point out that the audit procedure is more effective by utilizing continuous auditing. Due to the fact, continuous auditing enables to put the focus on high risks and errors/deviations. Therefore, the focus is on the real issues within an organization, and follow-up actions on errors/deviations can be easily monitored. Furthermore, organization A and C point out that the people of the internal audit no longer have to focus on finding errors/deviations, but that these people are capable to solving or preventing these errors. So, continuous auditing provides a more effective audit, by means of putting the focus on solving and preventing errors/deviations, instead of finding it.

- More frequent audit
  Organization A, C, D, and E point out that the audit procedure is more frequent by utilizing continuous auditing. Due to the fact, audit procedures are automated, and therefore less manual procedures are required. However, the frequency of the audit is organization dependent. Each organization has its own interpretation of continuous, which is quarterly, weekly, daily or real-time. It is organization dependent which audit cycle is feasible.

- Improved reporting and decision making
  Organizations A and C point out that continuous auditing enables more frequent reporting and higher quality of reporting. Due to the fact, these automated audit processes and procedures result in a standard way of reporting, which reduces the differences in interpretation. Furthermore, it enables managers to react to information in real time, that follow-up actions are taken more frequently, and errors/deviations do not build up.

- Scalability
  Organization A. C, and D point out that It is possible to implement continuous auditing in phases. Therefore, organizations can start implementing by means of a pilot or experimenting, or as organization A described it as an *'experimental ground'*. In the case the pilot is successfully implemented, it is feasible to extend the scope of continuous auditing. Organization C point out that the scalability is a crucial benefit for the implementation of continuous auditing, due to the possibility *'the organization can growth 10 times without hiring additional people 10 times'*. So, continuous auditing capable to scale up the work-load, without additional extensions of the internal control.

So, implementing continuous auditing enables several benefits, which provide a more valuable audit for the organization. However, not every organization acknowledges each benefit, it is organization dependent which benefits are applicable, and to what extent. Nevertheless, all organizations acknowledge that continuous auditing provides the benefits to improve the quality of the internal audit and the quality of the business process. Due to the possibility to detect, or even prevent errors/deviations closers to the process. Furthermore, experts point out that improving the awareness of these benefits internally embraces the adoption of continuous auditing.

17.4 Discussion sub-question 3

To arrive at the sub-conclusion conclusion regarding sub-question 3, theoretical and practical findings are compared, which will result in an overview of similarities and contradictories in theory and practice. The chapter is subdivided into three parts; importance of utilizing continuous auditing, preconditions of continuous auditing, and the benefits of continuous auditing.

- Importance of utilizing continuous auditing

  Despite, the importance of innovation and improvement of the internal audit, the degree of adoption of continuous auditing is low (Gonzalez et al., 2012). In this selected practical data sample, not a single organization has an integral implementation of the concept of continuous auditing. Which is a noticeably finding due to the fact Vasarhelyi et al. (2012) suggests that continuous auditing is utilized by the majority of organizations. That means a lot of organizations have implemented the concept of continuous auditing, and which suggests that there are organizations who have implemented continuous auditing according to the level of maturity of level five.

  Organizations acknowledge the importance of innovation and improvement of the internal audit. However, there are still differences in opinion to what extent continuous auditing provides added value to the organization. Especially, organizations who have implemented continuous auditing, to a certain extent, acknowledge the importance of utilizing continuous auditing. In the theory are several demands discussed regarding the utilization of continuous auditing

- Preconditions continuous auditing

  An organization should possess several pre-conditions, in order to successfully implement and adopt continuous auditing. The discussed drawbacks in the theory are like a 'synonym' for pre-conditions regarding continuous auditing. Due to the fact, organizations have to comply with these pre-conditions which could lead to a drawback. There are several theoretical drawbacks similar to the practical pre-conditions regarding continuous auditing, which are interlinked by the black arrows. For an overview of the theoretical drawbacks and practical pre-conditions, refer to table 10.

Theoretical drawbacks	Practical pre-conditions
- Internal control	- Internal control
- Increase costs	- IT-environment
- IT-infrastructure	- A low frequency of changes
- Human capital	- Automated processes
	- Continuous monitoring
	- Human Capital
	- Budget
	- Changeability of the organization

Table 10 Theoretical drawbacks and practical pre-conditions

Firstly, not every organization is capable to implement continuous auditing, it depends on the maturity of internal control (Rikhardsson & Dull, 2016). An organization who intends to implement continuous auditing should at least have an internal control maturity level 3. Otherwise, implementing continuous auditing is not practicable and feasible.

Secondly, adopting continuous auditing leads to an increase in costs, by means of investments in hardware and software (Alles et al., 2006; Kogan et al., 1999). Additionally, practical findings indicate that a budget should be provided to provide the ability to hire people with the appropriate knowledge regarding continuous auditing. So, adopting continuous auditing leads to an increase in costs which could be facilitated by providing a budget which enables to invest in hardware, software, and people.

Thirdly, to perform continuous auditing the organization requires a certain level of IT-infrastructure (Vasarhelyi et al., 2012). Practical findings indicate that the maturity of the IT-environment is embedded within the ITGC's and application controls, which should be effective. Additionally, continuous auditing cannot be performed without a strong infrastructure of automation (Chiu et al., 2014). Practical findings indicate that manual processes should be normalized, in order to automate because manual processes decelerate the process of continuous auditing. So, adopting continuous requires an IT-environments consisting of automated processes.

Fourthly, continuous auditing requires human capital. Continuous auditing is driven by rapid knowledge development (Chiu et al., 2014). This knowledge should cover areas such as; technology and the audit practice (Vasarhelyi et al., 2012). Practical information extended the area of knowledge with; data analytics and the business processes. So, adopting continuous auditing requires human capital covering several different areas of knowledge.

However, practical findings provided additional information to the theoretical findings. By means of additional pre-conditions; a low frequency of changes, continuous monitoring, and changeability of the organization. So, there are several similarities between the theoretical- and practical findings regarding the preconditions (or drawbacks) of continuous auditing. Nevertheless, practical information extended these drawbacks with additional pre-conditions. So, the current state of the literature does not provide a comprehensive overview of pre-conditions regarding continuous auditing, which leads to a successful implementation and subsequently a higher adoption of continuous auditing.

- Benefits of continuous auditing

The potential benefits of adoption continuous auditing have been described both in theory and in practice. Awareness of these benefits entails the motivation to implement continuous auditing and increase the degree of adoption of continuous auditing in practice. There are several theoretical benefits similar to the practical benefits regarding continuous auditing, which are interlinked by the black arrows. For an overview of the theoretical and practical benefits of continuous auditing, refer to table 11.

Theoretical benefits	Practical benefits
- Reduce risk	- Higher quality of business processes
- Reduce cost	- Higher quality of the audit
- Organizational resilience	- More effective audit
- Value creation	- More efficient audit
	- More frequent audit
	- Improved reporting and decision making
	- Scalability

Table 11 Theoretical- and practical benefits

In the case, continuous auditing is implemented, integral or to a certain extent, it provides several benefits for the organization. In theory, these benefits are categorized in; reduce risk, reduce cost, organizational resilience, and value creation. In practice, there were some additional benefits described, which could roughly be categorized in the described benefits in theory.

Firstly, continuous auditing reduces risks. Both theoretical and practical findings indicate that continuous auditing enables to test 100% of the data instead of data sampling, which increases the quality of audit (Razaee et al., 2001; Razaee et al., 2002). Additional, practical findings indicate that continuous auditing improves the quality of business processes because continuous auditing enables insights in business processes to redesign it and mitigate risks. Furthermore, continuous auditing enables a more effective audit which reduces risks (Brown et al., 2007; Vasarhelyi et al., 2012). Practical findings indicate the audit is more effective by means of putting the focus on solving and preventing errors/deviations, instead of finding it.

Secondly, in theory, continuous auditing enables a reduction of costs related to the internal audit (Vasarhelyi et al., 2012; Alles et al., 2006). However, in practice, no interviewee pointed out that continuous auditing enables to reduce costs. In the beginning, continuous auditing increases the costs, by means of investments in human capital, time, and technologies. Furthermore, organizations find it difficult to demonstrate the financial results of continuous auditing. However, continuous auditing enables a more efficient audit, by means of less time is required for the internal audit. So, continuous auditing does not enable a demonstrable reduction of costs in practice.

Thirdly, continuous auditing enables to improve the organizational resilience in a changing environment. Continuous auditing enables to detect, anticipate, adapt, and learn from environmental changes (Lee et al., 2013; Lengnick-Hall et al., 2011). By means of improved reporting and decision making. Due to the fact, continuous auditing reports are in a standard which reduces differences in interpretation and improves real-time decision making by more frequent reporting. So, organizations are capable to report and make decisions in real-time which improves the organizational resilience.

Fourthly, continuous auditing creates value for organizations. Because continuous auditing provides financial statements which are; closer to operational process, higher quality of the information, which results in continuous assurance (Alles et al., 2006; Chan & Vasarhelyi, 2011; Vasarhelyi et al., 2012). However, in practice, continuous assurance is not mentioned as a benefit of continuous auditing. While value creation is mentioned as a more frequent audit, which is valuable for the organization. Furthermore, the scalability of continuous auditing is valuable for organizations. Because a successful pilot implementation of continuous auditing enables to scale up the work-load, without additional extension of the internal control.

So continuous auditing enables several benefits. However, not every organization acknowledges each benefit, it is organization dependent which benefits are applicable, and to what extent. Furthermore, theoretical benefits are similar to practical benefits. However, a demonstrable reduction in costs is not experienced in practice.

17.5 Conclusion sub-question 3

Despite of the acknowledgement of the importance of utilizing continuous auditing in practice and the possible benefits continuous auditing enables, the current adoption of continuous auditing in practice is relative low. Therefore, the objective of this sub-question is to provide an overview of how the degree of adoption of continuous auditing can increase in practice, to answer the sub-question 3: *'How can the degree of adoption of continuous auditing increase in practice?'*.

The pre-conditions regarding the implementation of continuous auditing are complex. Especially, a combination of these pre-conditions. The most important pre-conditions regarding the implementation of continuous auditing are the maturity of internal control and IT-environment. Otherwise, it is not feasible to implement continuous auditing. In order to adopt continuous auditing, organizations should firstly attract human capital. This human capital is valuable regarding the implementation and adoption of continuous auditing. Due to the fact, these people will enable the organization to improve the pre-conditions related to continuous auditing. These people can clearly identify, and communicate within the organization the related benefits of adopting continuous auditing. The described pre-conditions provide an overview of factors which facilitate the implementation, and thereby the adoption of continuous auditing in practice. Despite, that the describe pre-conditions are not a list that an organization has to comply each. Organizational awareness of these pre-conditions could improve a successful implementation of continuous auditing. Due to the fact, organizations acknowledge where there is room for improvement before implementing continuous auditing. Thereby, improve the adoption of continuous auditing in practice.

So, in order to improve the adoption of continuous auditing practice, organizations should strike a balance to what extent continuous auditing is feasible. On the one hand, organizations should adopt some improvements regarding the preconditions, on the other hand, continuous auditing enables several benefits. Therefore, organizations should acquire human capital who thoughtful plan to what extent continuous auditing will be adopted, to be beneficial.

V Conclusion

This part describes the conclusions regarding this research. Firstly, the theoretical background is compared and combined with the practical findings, which result in the discussion part. Secondly, the conclusions are described, to answer the main research question and research sub-questions. Finally, the limitations regarding this research, and suggestions for future research are described.

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18 Discussion

In order to arrive at the final conclusion regarding this research, theoretical and practical findings are compared, which will result in an overview of similarities and contradictories in theory and practice. Detail discussions are provided per sub-chapter, in order to compare theoretical- and practical findings and in a systematic and comprehensive method. This chapter provides a more generic discussion, based on the detailed discussions per sub-chapter.

Research and development of the concept of continuous auditing started almost 30 years ago. Alles et al. (2008) point out that continuous auditing is one of the rare instances in which innovation in accounting practice has been developed and driven by the academic community, as opposed to the usual model in which researched use data to investigate practices in a particular field. This theoretical research resulted in a variety of theories and concepts related to continuous auditing. However, in practice, there are some significant differences in interpretation and utilization of continuous auditing and interrelated concepts, continuous monitoring, and continuous assurance. In theory, there is a clear distinction made between the interrelated concept of continuous auditing (Alles et al., 2006; Vasarhelyi et al., 2012). While in practice the boundaries between these interrelated concepts are beginning to blend together.

Despite, the theoretical development of continuous auditing, the degree of adoption of continuous auditing is low. In this selected practical data sample, not a single organization has an integral implementation of the concept of continuous auditing. Which is a noticeably finding due to the fact Vasarhelyi et al. (2012) suggests that continuous auditing is utilized by the majority of organizations. That means a lot of organizations have implemented the concept of continuous auditing, and which suggests that there are organizations who have implemented continuous auditing according to the level of maturity of level five.

To conclude, the theoretical development of continuous auditing is substantial. However, there is a mismatch in certain areas related to the implications of continuous auditing. There are some contradictories or additions in the practical findings regarding the theoretical findings of continuous auditing.

19 Conclusion

The main objective of this research is to provide an overview of the concept of continuous auditing and to provide an overview of how the implementation of continuous auditing can be facilitated. In order to provide these overviews, the following research question is formulated: *'How can the implementation of continuous auditing be facilitated, in order to improve the adaption of continuous auditing in practice?'*. To answer the research question, there is qualitative research conducted. Firstly, is literature consulted, by means of comparing and combining different theories and concepts related to continuous auditing. Secondly, is practical information collected and analyzed by means of interviews related to continuous auditing. In order to formulate the conclusion regarding this research, the theoretical findings are compared and combined with the practical findings. In order to structure the conclusion, it is subdivided into subparts.

- Continuous auditing

  Continuous auditing is considered as an audit approach performed by the internal audit to conduct effective integrated auditing and monitoring by utilizing technology to continuously gather data from the operational processes and management information systems. The timing of the audits is to report events continuous by providing 100% coverage. Continuous auditing is an audit approach to data processing. However, this is a catch-all term, therefore the data processing is subdivided into four phases, which are described and visualized in the continuous auditing framework. The four phases consist of; data acquisition, data extraction, transformation and loading, data analyzing, and continuous auditing reporting. The continuous auditing framework is an overview of the concept of continuous auditing.

  From a theoretical perspective, there has been too much pushing in the past in the range of different interrelated concepts which are; continuous auditing, continuous monitoring, and continuous assurance, than that there has been looked at the need in practice. However, the boundaries of the interrelated concepts of continuous auditing are beginning to vague. Due to the fact, how the concept is called is becoming irrelevant, because it mediates the same objective(s).

- Implementation of continuous auditing

  The implementation process of continuous auditing is a large and complex process. To successfully implement continuous auditing, organizations should acquire human capital, internally and/or externally. Especially, a combination of knowledge regarding audit, IT, analytics, and business. Organizations should take the key elements regarding continuous auditing into account; technology, people, process, and data. The combination of these key elements ensures that the implementation of continuous auditing can ultimately be successful. There are additional pre-conditions discussed related to continuous auditing which organizations should take into account when implementing continuous auditing. Most of all, the organizational motivation and changeability are the foundation for a successful implementation process of continuous auditing. The implementation process of continuous auditing requires an integral approach, which organizations should take several key elements and pre-conditions into account.

  The implementation processes of continuous auditing can be facilitated by means of pilots or trials because the implementation of continuous auditing is a large and complex process. Pilots and trials offer the opportunity to learn, how to perform continuous auditing effectively and efficiently, and to demonstrate the value of continuous auditing internally. Furthermore, continuous auditing is characterized by its scalability. In the case the pilot is successfully implemented, it is feasible to extend the scope of continuous auditing. Nevertheless, there is no *'good practice'* regarding the design and implementation of continuous auditing. The implementation process requires comprehensive planning of each phase of the continuous auditing process. The implementation process of continuous auditing should be reviewed after execution. Due to the fact, business processes and/or internal controls should adapt to the faster increasing organizational environment. Therefore, the internal control framework of continuous auditing should be adapted to these change, to mitigate the related risks.

Which is a contradictory finding with the pre-condition that continuous auditing requires a low frequency of changes, so organizations have to find a balance in this field of tension. Hence, the process of implementation of continuous auditing is a continuous and comprehensive cycle of implementation and adaption.

- Improve adoption of continuous auditing

  Despite, the importance of innovation in the internal audit and the potential benefits of a successful implementation, the adoption of continuous auditing is relative low. The adoption of continuous auditing is relatively low because the implementation is not facilitated by the current status of theoretical development of continuous auditing, there is a mismatch between theoretical development and practical implications. For example, organizations do not have an overview which pre-conditions facilitate a successful implementation of continuous auditing.

  In the case, continuous auditing is implemented, integral or to a certain extent, it provides several benefits and a more valuable audit for the organization. These benefits differ per organization, but are categorized in; reduce of risks, reduce in costs, improvement of organizational resilience, and improvement of business value. Awareness of these benefits and the possible added value entails the organizational motivation to implement continuous auditing, and increase the degree of adoption of continuous auditing in practice. However, continuous auditing does not enable immediately a demonstrable reduction of costs related to the audit. Therefore, the organization should strike a balance to what extent implementing continuous auditing is feasible. So, a clear overview of the implementation process, awareness of the benefits, and pre-conditions could improve the practical adoption of continuous auditing.

To conclude, the theoretical development did not correspondent with the practical needs regarding the implementation of continuous auditing. Due to the fact, organizations no longer saw any merit in all the different concepts, and the boundaries between these concepts make it difficult for organizations to understand and utilize these concepts. So, continuous auditing has been driving all along by its theoretical possibilities and not the practical needs. To improve the adoption of continuous auditing in practice, there should be more collaboration between practical and scientific development related to continuous auditing. This research provides an overview of the continuous auditing concept and the implementation process. Additional research could extend these overviews because there is no 'good practice' of a continuous auditing design and implementation process. Combining and comparing additional information will enhance the generalization of these overviews. This can result in valuable information which can provide a guide for organizations to successfully implement continuous auditing, and subsequently improve the adoption of continuous auditing in practice.

20 Limitations and future research

The objective of this research is to provide an overview of the concept of continuous auditing and how to facilitate the implementation process of continuous auditing. There are several limitations and suggestions for future research, which are described in this chapter.

The first limitation of this research is the generalization of the findings. Due to the fact, the utilization of continuous auditing is organizational specific. Each organization has developed its own design and layout for the implementation and adoption of continuous auditing. Despite the interesting findings, we should be careful about establishing the generalization regarding these findings. Therefore, a suggestion for future research is adopting a quantitative research method, to extend the data sample national or even international. In order to uncover the similarities between each organizational design and layout for the adaption of continuous auditing, which could provide findings which can be generalized based on statistics.

The second limitation of this research is that the data sample is limited. Due to the fact, the concept of continuous auditing is for a lot of organizations *'still a point far on the horizon'*. Furthermore, the data sample does not contain an organization with an internal maturity level five, or in other words an integral implementation of continuous auditing. This is a limitation because, an organization with such a mature internal control level, could provide valuable information. Due to the fact, such an organization have experienced all the phases of maturity and therefore, have experienced all benefits and limitations regarding the implementation of continuous auditing. Therefore, a suggestion for future research is to conduct research including organizations with maturity level five, applying the same research methods during this research. In order to determine whether organizations with a mature level five provide additional information regarding the concept and implementation of continuous auditing.

The third limitation of this research is that the qualitative research methods applied in this research did not provide an in-depth understanding of the practical utilization of the concept of continuous auditing. Due to its complexity, it is not possible to collect practical findings with the utilized methods applied during this research. Therefore, a suggestion for future research is, conducting a case study at an organization who have implemented continuous auditing to a certain extent, so maturity level four. Due to the possibility to study the utilization of continuous auditing in practice, and furthermore, it is possible to study the implementation process of continuous auditing because such an organization is still able to extend the scope of continuous auditing.

Additional, a suggestion for future research is to conduct research regarding the implementation strategy of continuous auditing. Due to the fact, there are roughly two streams of implementation strategies; the waterfall approach and the agile approach. It would be helpful for organizations to clarify which implementation strategy will lead to a successful implementation.

Furthermore, a suggestion for future research is to conduct branch specific research regarding continuous auditing. In order to clarify if there are any differences or similarities between the degree of adoption of continuous auditing. Additionally, if there are any differences or similarities in the utilization and implementation of continuous auditing.

Moreover, a suggestion for future research is to conduct research focused on the pre-conditions for the implementation of continuous auditing. This research provided an overview of these pre-conditions, however, it was not the objective of this research. Therefore, comprehensive research regarding the pre-conditions for the implementation of continuous auditing could provide an overview for organizations. In order to create awareness of these pre-conditions, which could improve the implementation process and thereby could improve the degree of the adoption of continuous auditing in practice.

Hence, continuous auditing is an interesting topic for research. Due to the fact, the organizational environment is changing, and organizations should adapt to these changes in order to sustain competitively. However, there is a research gap between theoretical development and practical development. Therefore, there is enough space for future research, to close this research gap.

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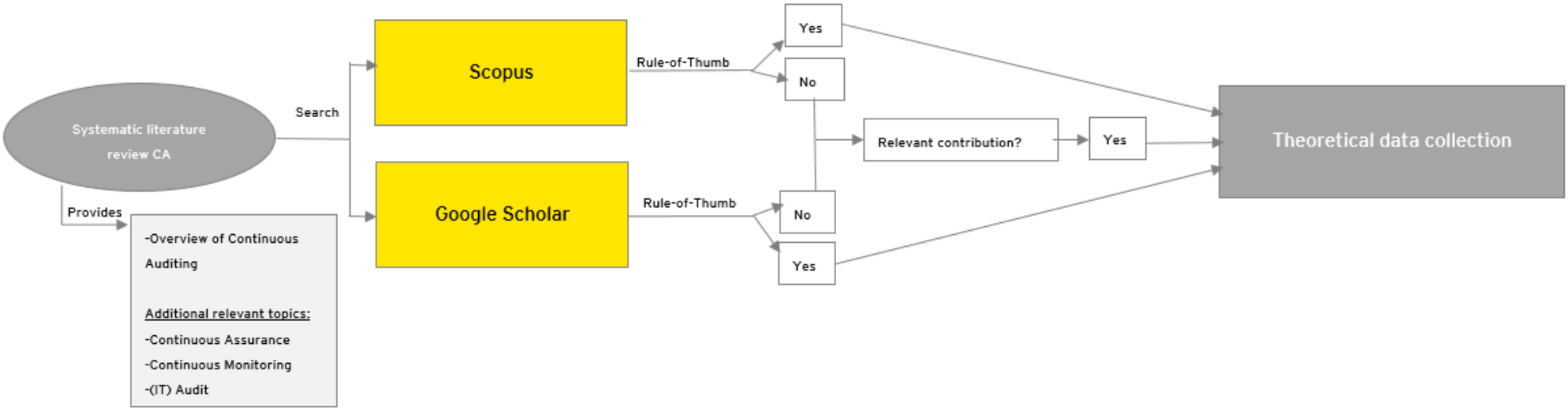
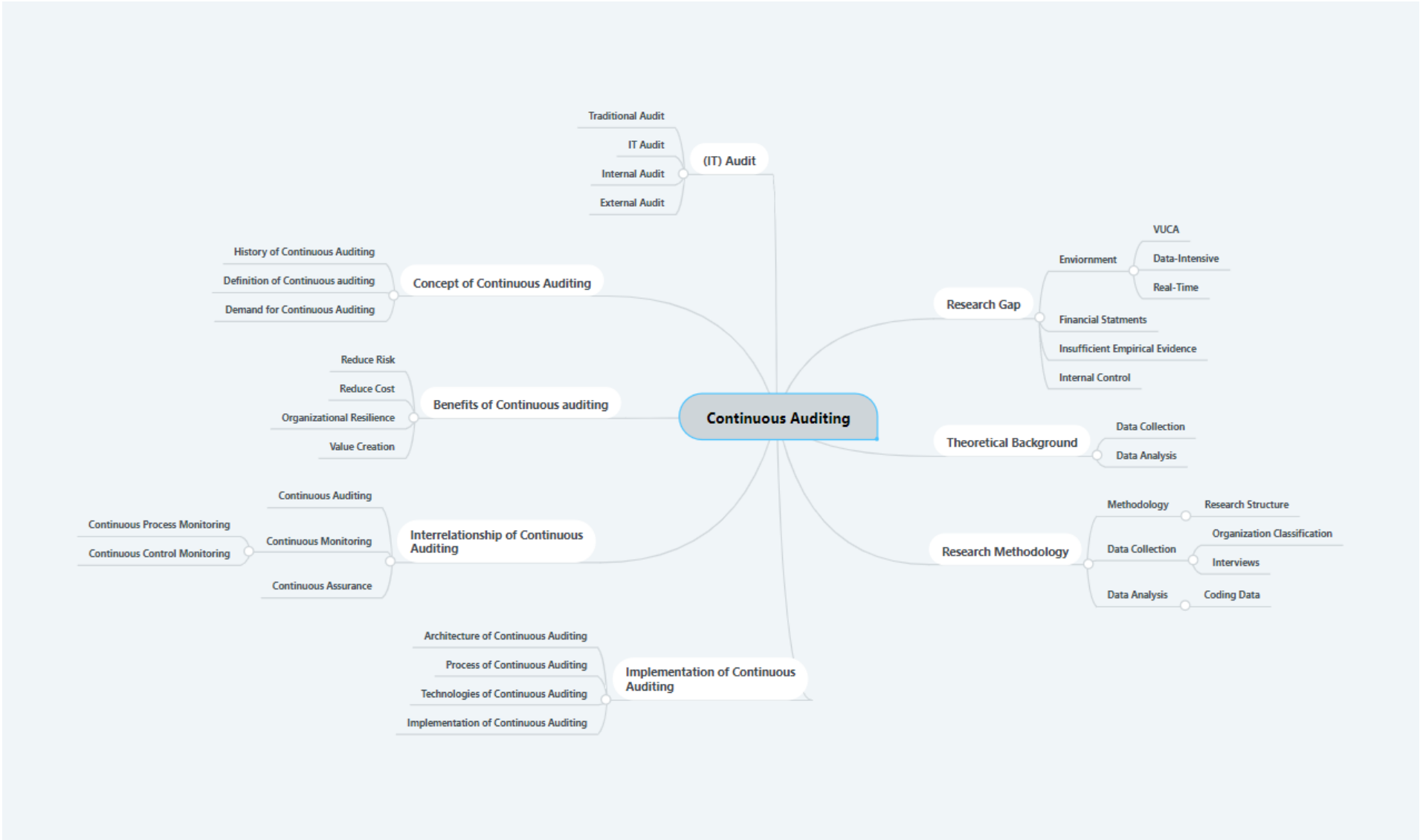
Appendix

Appendix A Theoretical data collection



Appendix B Interrelationship of theories



Appendix C Theories per (sub) topic

Source	Sub-Topic	Topic	Research topic
(Bennet & Lemoine, 2014)	VUCA environment	Problem description / Research Gap	Continuous auditing
(Alles, Kogan, &, Vasarhelyi, 2008)	Data-intensive, and real-time environment		
(Chan & Vasarhelyi, 2011)			
(Rezaee, Sharbatoghlie, Elam, & McMickle, 2002)	Real-time financial statements		
(Chan & Vasarhelyi, 2011)			
(Rezaee, Elam, & Sharbatoghlie, 2001)			
(Chiu, Liu, & Vasarhelyi, 2014)	Insufficient empirical evidence related to continuous auditing		
(Vasarhelyi, Alles, & Kogan, 2004)			
(Vasarhelyi, Alles, Kuenkaikaew, & Littley, 2012)			
(Brown, Wong, & Baldwin, 2007)			
(Alles, Brennan, Kogan, & Vasarhelyi ,2006)			
(Rezaee, Sharbatoghlie, Elam, & McMickle, 2002)			
(Alles, Kogan, & Vasarhelyi, 2013)			
(Rezaee, Elam, & Sharbatoghlie, 2001)	Internal control		
(Doyle, Ge, & McVay, 2007)			
(Krishnan, 2005)			
(Vasarhelyi, Alles, Kuenkaikaew, & Littley, 2012)			
(Lee, Vargo, & Seville, 2013)			
(Tranfield, Denyer, & Smart, 2003)	Objective of theoretical data	Theoretical data collection and analysis	
(Wolcott, 2002)			
(Corley & Gioia, 2011)			
(Oxman & Guyatt, 1993)	Theoretical data collection		
(Day & Peters, 1994)			
(Oswick, Fleming, & Hanlon, 2011)	Theoretical data analysis		

Source	Sub-Topic	Topic	Research Topic
(Kuenkaikaew & Vasarhelyi, 2013)	Traditional Audit	(IT) Audit	Continuous auditing
(Alles, Brennan, Kogan, & Vasarhelyi ,2006)			
(Rezaee, Sharbatoghlie, Elam, & McMickle, 2002)			
(Chan & Vasarhelyi, 2011)			
(Vasarhelyi, Alles, Kuenkaikaew, & Littley, 2012)			
(Rezaee, Elam, & Sharbatoghlie, 2001)			
(Kogan, Sudit, & Vasarhelyi, 1999)			
(Francis, 2004)			
(Barua, Kriebel, & Mukhopadhyay, 1995)	IT Audit		
(Janvrin, Bierstaker, & Lowe, 2008)			
(Umble, Haft, & Umble, 2003)			
(Stoel, Havelka, & Merhout, 2012)			
(Rezaee, Elam, & Sharbatoghlie, 2001)			
(Coombs, Knights, & Willmott, 1992)			
(Weidenmier & Ramamoorti, 2006)			
(Doyle, Ge, & McVay, 2007)	Internal- and external audit		
(Krishnan, 2005)			
(Adams, 1994)			
(Collier & Gregory, 1996)			
(Felix, Gramling, & Maletta, 2001)			
(Abbott, Parker, & Peters, 2012)			
(Simunic, 1984)			
(Schneider, 1985)			
(Goodwin & Yeo, 2001)			
(Goodwin-Stewart & Kent, 2006)			

Source	Sub-Topic	Topic	Research Topic
(Groomer & Murthy, 1989)	History of continuous auditing	Concept of continuous auditing	Continuous auditing
(Vasarhelyi & Halper, 1991)			
(Alles, Kogan, &, Vasarhelyi, 2008)			
(Alles, Brennan, Kogan, & Vasarhelyi ,2006)			
(Bierstaker, Burnaby, & Thibodeau, 2001			
(Flowerday, Blundell, & Von Solms, 2006)			
(Alles, Brennan, Kogan, & Vasarhelyi ,2006)	Definition of continuous auditing		
(Vasarhelyi, Alles, Kuenkaikaew, & Littley, 2012)			
(Chiu, Liu, & Vasarhelyi, 2014)			
(Alles, Kogan, &, Vasarhelyi, 2008)			
(Vasarhelyi, Alles, & Kogan, 2004)			
(Chan & Vasarhelyi, 2011)			
(Rezaee, Sharbatoghlie, Elam, & McMickle, 2002)			
(Rikhardsson & Dull, 2016)			
(Hunton, Wright, & Wright, 2004)	Demand for continuous auditing		
(Rezaee, Sharbatoghlie, Elam, & McMickle, 2002)			
(Brown, Wong, & Baldwin, 2007)			
(Chan & Vasarhelyi, 2011)			
(Rezaee, Elam, & Sharbatoghlie, 2001)			
(Chiu, Liu, & Vasarhelyi, 2014)			
(Vasarhelyi, Alles, Kuenkaikaew, & Littley, 2012)			
(Kogan, Sudit, & Vasarhelyi, 1999)			
(Cash, Baily, & Whinston, 1977)			
(Rikhardsson & Dull, 2016)			
(Alles, Kogan, &, Vasarhelyi, 2002)			

Source	Sub-Topic	Topic	Research Topic
(Alles, Brennan, Kogan, & Vasarhelyi ,2006)	Development of continuous monitoring	Continuous monitoring	Continuous auditing
(Chiu, Liu, & Vasarhelyi, 2014)			
(Vasarhelyi, Alles, & Kogan, 2004)			
(Kuhn & Sutton, 2010)			
(Alles, Kogan, &, Vasarhelyi, 2008)			
(Vasarhelyi, Alles, Kuenkaikaew, & Littley, 2012)			
(Brown, Wong, & Baldwin, 2007)			
(Chan & Vasarhelyi, 2011)	Development of continuous assurance	Continuous assurance	
(Rezaee, Sharbatoghlie, Elam, & McMickle, 2002)			
(Vasarhelyi, Alles, & Kogan, 2004)			
(Alles, Kogan, &, Vasarhelyi, 2008)	Demand for continuous assurance		
(Kuhn & Sutton, 2010).			
(Chan & Vasarhelyi, 2011)			
(Vasarhelyi, Alles, Kuenkaikaew, & Littley, 2012)	CA/CA/CM	Interrelationship	
(Alles, Brennan, Kogan, & Vasarhelyi ,2006)			

Source	Sub-Topic	Topic	Research Topic
(Rezaee, Sharbatoghlie, Elam, & McMickle, 2002)	Reduce Risk	Benefits	Continuous auditing
(Rezaee, Elam, & Sharbatoghlie, 2001)			
(Brown, Wong, & Baldwin, 2007)			
(Vasarhelyi, Alles, Kuenkaikaew, & Littley, 2012)			
(Rikhardsson & Dull, 2016)			
(Davidson, Gregory, & Gerard, 2013).			
(Vasarhelyi, Alles, Kuenkaikaew, & Littley, 2012)	Reduce cost		
(Alles, Brennan, Kogan, & Vasarhelyi ,2006)			
(Rezaee, Elam, & Sharbatoghlie, 2001)			
(Rezaee, Sharbatoghlie, Elam, & McMickle, 2002)			
(Brown, Wong, & Baldwin, 2007)			
(Alles, Kogan, &, Vasarhelyi, 2002)			
(Pathak, Chaouch, & Sriram, 2005)			
(Lee, Vargo, & Seville, 2013)	Organizational resilience		
(Dutton, Frost, Worline, Lilius, & Kanov, 2002)			
(Coutu, 2002)			
(Lengnick-Hall, Beck, & Lengnick-Hall, 2011)			
(Alles, Kogan, &, Vasarhelyi, 2008)			
(Rikhardsson & Dull, 2016)	Value creation		
(Alles, Brennan, Kogan, & Vasarhelyi ,2006)			
(Chan & Vasarhelyi, 2011)			
(Vasarhelyi, Alles, Kuenkaikaew, & Littley, 2012)			
(Brown, Wong, & Baldwin, 2007)			
(Rezaee, Sharbatoghlie, Elam, & McMickle, 2002)			
(Farkas & Murthy, 2014)			

Source	Sub-Topic	Topic	Research Topic
(Brown, Wong, & Baldwin, 2007)	Architecture of continuous auditing	Implementation	Continuous auditing
(Groomer & Murthy, 1989)			
(Kuhn & Sutton, 2010)			
(Umble, Haft, & Umble, 2003)			
(Alles, Kogan, &, Vasarhelyi, 2008)			
(Rezaee, Sharbatoghlie, Elam, & McMickle, 2002)			
(Chan & Vasarhelyi, 2011)			
(Vasarhelyi, Alles, & Kogan, 2004)			
(Woodroof & Searcy, 2001)			
(Chan & Vasarhelyi, 2011)	Process of continuous auditing		
(Alles, Brennan, Kogan, & Vasarhelyi ,2006)			
(Vasarhelyi, Alles, & Kogan, 2004)			
(Alles, Kogan, &, Vasarhelyi, 2008)			
(Chiu, Liu, & Vasarhelyi, 2014)			
(Vasarhelyi, Alles, Kuenkaikaew, & Littley, 2012)			
(Flowerday, Blundell, & Von Solms, 2006)			
(Brown, Wong, & Baldwin, 2007)	Technologies of continuous auditing		
(Zhang, Yang, & Appelbaum, 2015)			
(Lins, Schneider, & Sunyaev, 2016)			
(Woodroof & Searcy, 2001)			
(Rezaee, Sharbatoghlie, Elam, & McMickle, 2002)			
(Murthy & Groomer, 2004)			
(Alles, Brennan, Kogan, & Vasarhelyi ,2006)	Implementation of continuous auditing		
(Alles, Kogan, &, Vasarhelyi, 2008)			
(Rezaee, Sharbatoghlie, Elam, & McMickle, 2002)			

Source	Sub-Topic	Topic	Research Topic
(Drisko, 2005)	Methodology	Methodology	Research methodology
(Morrow, 2005)			
(Tracy, 2010)			
(Verschuren, Doorewaard,& Mellion, 2010)	Research Structure		
(Drisko, 2005)	Organization classification	Data collection	
(Morrow, 2005)			
(Tracy, 2010)			
(Vasarhelyi, Alles, Kuenkaikaew, & Littley, 2012)			
(Doyle, Ge, & McVay, 2007)			
(Krishnan, 2005)			
(Chan & Vasarhelyi, 2011)			
(Eisenhardt & Graebner, 2007)	Interviews		
(Walsham, 1995)			
(Rikhardsson & Dull, 2016)			
(Omoteso, Patel, & Scott, 2008)			
(Burnard, 1991)			
(Fusch & Ness, 2015)			
(Morse, 1994)			
(Hennink, Kaiser & Marconi, 2016)			
(Patton, 1990)			
(Basit, 2003)	Coding data	Data analysis	
(Burnard, 1991)			
(Drisko, 2005)			
(Jones, 2007)			
(Fereday & Muir-Cochrane, 2006)			
(Corbin and Strauss, 1990)			
(Elo & Kyngäs, 2008)			

Appendix D Interview guide level maturity 3

Date:	…….-…….-……
Level of maturity:	3
Topics	**Question**
Audit	-What is the current status of the internal/external audit? (3/4/5) a. Audit objective b. Audit & Monitoring approach c. Data capture & access d. Audit automation e. Analytical methods
Continuous auditing	-How would you define continuous auditing? -Is there a demand for continuous auditing in your organization?
Continuous monitoring & Continuous assurance	-How would you define continuous monitoring and continuous assurance? -How would you define the relationship of continuous-monitoring, assurance, and auditing?
Implementation	-Are there ambitions to implement continuous auditing within the future? -What are the barriers for the implementation of continuous auditing? -What would be helpful in order to implement continuous auditing within the future? a. Information b. External advice c. Other
Future development	-How will internal control develop in your organization, in the coming years?

Appendix E Interview guide level maturity 4/5

Date:	…….-…….-……
Level of maturity:	4/5
Topics	**Question**
Audit	-What is the current status of the internal/external audit? (3/4/5) a. Audit objective b. Audit & Monitoring approach c. Data capture & access d. Audit automation e. Analytical methods
Continuous auditing	-How would you define continuous auditing? -How would you describe the process of continuous auditing? a. Standardization of audit procedures/data/ internal control b. Alarm/exception reporting
Continuous monitoring & Continuous assurance	-How would you define continuous monitoring and continuous assurance? -How would you define the relationship of continuous-monitoring, assurance, and auditing?
Implementation	-To what extent is continuous auditing implemented? -What are the preconditions in order to implement continuous auditing? -How was the implementation process of continuous auditing? a. Architecture b. Process c. Enabling technologies d. Step-wise-process of implementation e. Other -What were the motivations to implement continuous auditing? a. Regulations b. Possible benefits (cost, risk, resilience, business value) c. Other -What are factors to take into account in order to facilitate the implementation of continuous auditing? a. Barriers b. Preconditions What are success factors for an implementation of continuous auditing?

Impact	-What impact has the adoption of continuous auditing had on the organization? a. Businesses process b. Internal audit (Financial/IT) c. Other -What where the benefits of the implementation of continuous auditing? a. Risk b. Cost c. Business value d. Other -Has there been an impact with external relations? a. External audit b. Investors c. Other -Is the quality of the audit improved by continuous auditing?
Training	-Were personnel in the organization trained in the use or interpretation of continuous auditing? From what functions? -What kind of training was provided and by whom? -Was the amount of time assigned to training sufficient? -What difficulties were encountered in the training process? How were they overcome?
Future development	-How will internal control develop in your organization, in the coming years?

Appendix F Data analysis coding scheme

Data	Inductive coding	Open Coding	Axial Coding	Selective Coding
Anonymous quotes	Internal audit and continuous auditing	Conceptual description internal audit	Developments Internal audit	(Sub-question 1) Concept of continuous auditing
	Errors/deviations mitigation			
	First line of defense, process level	Three lines of defense internal audit		
	Second line of defense, risk management & compliance			
	Third line of defense, internal audit			
	External changes direct	Trends & developments internal audit		
	Shorter change cycle			
	Industry convergence			
	External changes indirect			
	Internal changes			
	Upside risks	Type of risks		
	Outside risks			
	Downside risks			
	Descriptive reporting	Internal audit reporting		
	Predictive reporting			
	Prescriptive reporting			
	GRC technologies	Global trends continuous auditing	Continuous auditing	
	Maturity level internal control			
	GRC technologies	Local trends continuous auditing		
	Maturity level internal control			
	Definition continuous auditing	Conceptual description continuous auditing		
	Interpretation continuous auditing			

Data	Inductive coding	Open Coding	Axial Coding	Selective Coding
Anonymous quotes	Management information systems and applications	Data acquisition	Continuous auditing framework	(Sub-question 1) Concept of continuous auditing
	Scoping in relation with data			
	Secured mechanism			
	Data extraction, data files	Data extraction, transformation, loading		
	Data transformation, uniformly format			
	Data quality assessment			
	Data uploading			
	Continuous auditing data store	Data processing		
	Continuous auditing tool			
	Objective data processing			
	Skills data processing			
	Reports	Continuous auditing reporting		
	Dashboards			
	Exception reporting			
	Objective reporting			
	First line of defense	Continuous monitoring	Interrelationship: continuous-auditing, monitoring, and assurance	
	Continuous process monitoring			
	Continuous control monitoring			
	Overall/cross-cutting concept	Continuous assurance		
	Formality of internal control			
	Continuous monitoring foundation	Interrelationship CA/CM/CA		
	Continuous assurance umbrella term			

Data	Inductive coding	Open Coding	Axial Coding	Selective Coding
Anonymous quotes	Continuous auditing technology	Continuous auditing technology	Key elements continuous auditing	(Sub-question 2) Implementation process of continuous auditing
	Usage of continuous auditing technology			
	Scalability of continuous auditing technology			
	Designing	Continuous auditing people		
	Implementation			
	Human knowledge			
	Human capabilities			
	Mindset			
	Changeability of people			
	Business processes	Continuous auditing process		
	Normalization business processes			
	Automation business processes			
	Manual processes			
	Life line continuous auditing	Continuous auditing data		
	Data assessment			
	Access data	Data management	Continuous auditing tool	
	Verify data			
	Store data			
	Integrate data	Data integration		
	Transform data			
	Continuous analytics	Analytics and Reporting		
	Continuous reporting			
	Automate processes	Automation		
	Reduce manual actions			

Data	Inductive coding	Open Coding	Axial Coding	Selective Coding
Anonymous quotes	Thoughtful planning	Planning	Implementation process continuous auditing	(Sub-question 2) Implementation process of continuous auditing
	Human capital, time, investments			
	Identify risks	Risk assessment		
	Overview risks			
	Ranking risks			
	Internal control framework	(Continuous) Internal control framework		
	Mitigating risks			
	Automated internal controls			
	Manual processes	Automate business processes		
	Automated processes			
	Real-time continuous data			
	Refer to Axial coding, Continuous auditing tool	Build continuous auditing tool		
	Refer to Axial coding, Continuous auditing framework	Execute continuous auditing		
	Internal auditors, management	Review		
	Improvement implementation			
	Scope extending			
	Effective and efficient implementation			
	Adapt to change			

Data	Inductive coding	Open Coding	Axial Coding	Selective Coding
Anonymous quotes	Trends and developments	Importance of continuous auditing	Importance of continuous auditing	(Sub-question 3) Adoption of continuous auditing
	Change readiness and competencies			
	Risk Gap			
	Maturity of internal control	Internal control	Pre-conditions continuous auditing	
	(continuous) internal control framework			
	ITGC			
	Application controls			
	Management information systems	IT-environment		
	Applications			
	ITGC's and applications controls			
	Changes internal control framework	Low frequency of changes		
	Application modifications			
	Flexible regarding changes			
	Normalization manual processes	Automated processes		
	Automated processes			
	Foundation of continuous auditing	Continuous monitoring		
	Continuously supply and access of data			
	Audit, IT, analytics knowledge	Human capital		
	Internal knowledge			
	External knowledge			
	People and time	Budget		
	Hardware and software			
	Organizational culture			
	Ability to change	Changeability of the organization		
	Complex and large process			
	Driver for change			

Data	Inductive coding	Open Coding	Axial Coding	Selective Coding
	Faster errors/deviations discovery	Higher quality of business processes	Benefits of continuous auditing	(Sub-question 3) Adoption of continuous auditing
	Change business processes			
	100% data	Higher quality of the audit		
	Data sampling			
	Less manual processes			
	Less time in audit	More efficient audit		
	Increased productivity			
	Focus on high risk	More effective audit		
	Follow-up actions			
	Automated procedures	More frequent audit		
	Less manual processes			
	More frequent reporting	Improved reporting and decision making		
	Standard reporting			
	Follow-up actions			
	Implementation in phases	Scalability		
	Pilot			
	Experimentation			
	Extent scope of audit			

Appendix G Interview response

Interviewees Organization -> Topics		A	B	C	D	E	Experts
15 Sub-question 1: What is continuous auditing from a practical perspective?							
15.1 Developments in the internal process		■	■	■	■	■	■
	Three lines of defence		■	■		■	
	Risk approach		■		■		■
	Reporting				■		■
15.2 Continuous auditing in practice		■	■	■	■	■	■
	Global and local trends	■	■	■	■	■	■
	The concept of continuous auditing	■	■	■	■	■	■
	Continuous auditing framework	■	■	■	■	■	■
	Phase 1	■		■	■		■
	Phase 2	■		■	■		■
	Phase 3	■			■		
	Phase 4	■			■		
15.3 Interrelationship, continuous- auditing, assurance, and monitoring		■	■	■	■	■	■
	Continuous monitoring	■	■	■	■	■	■
	Continuous auditing	■	■	■	■	■	■
	Continuous assurance	■	■	■	■	■	■

■ = Input per topic
■ = No input per topic

Interviewees Organization -> Topics		A	B	C	D	E	Experts
16 Sub-question 2: How can the implementation process of continuous auditing be facilitated?							
16.1 Key elements of continuous auditing		■		■	■		■
	Technology	■		■	■		
	People	■		■	■		
	Process	■		■	■		
	Data	■	■	■	■	■	
16.2 Continuous auditing tool		■		■	■	■	■
	Data management					■	■
	Data integration					■	■
	Analytics and Reporting					■	■
	Automation					■	■
16.3 Implementation of continuous auditing		■		■	■		
	Planning			■	■		
	Risk assessment			■			
	CA control framework			■	■		
	Automate processes	■	■	■	■	■	
	Build CA tooling	■		■	■		■
	Execute CA	■	■	■	■	■	■
	Review			■			

■ = Input per topic
■ = No input per topic

Interviewees Organization -> Topics		A	B	C	D	E	Experts
17 Sub-question 3: How can the degree of adoption of continuous auditing increase in practice?							
17.1 Importance of utilizing continuous auditing		■	■	■	■	■	■
	Risk Gap						■
	Importance of continuous auditing				■		
17.2 Preconditions of continuous auditing		■		■	■		
	Internal control	■		■	■		
	IT-environment	■		■	■		
	Low frequency of changes			■			
	Automated processes	■		■	■		
	Continuous monitoring	■		■	■		
	Human capital	■		■	■		
	Budget			■	■		
	Changeability of the organization	■		■			

■ = Input per topic
■ = No input per topic

Interviewees Organization -> Topics		A	B	C	D	E	Experts
17 Sub-question 3: How can the degree of adoption of continuous auditing increase in practice?							
17.3 Benefits of continuous auditing		■		■	■	■	
	Higher quality business processes	■		■	■		
	Higher quality of the audit	■		■	■	■	
	More efficient audit			■	■	■	
	More effective audit	■		■			
	More frequent audit	■		■	■	■	
	Improved reporting and decision making	■		■			
	Scalability	■		■	■		

■ = Input per topic
■ = No input per topic