

Master Thesis



Key Success Factors and Audit Maturity Level Evaluation in Organizations from Continuous Auditing Perspective



Maarsse, July 2023

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Abstract

Purpose – The purpose of this research is to explore and examine the key success factors and audit maturity level in the context of continuous auditing for organizations. It aims to identify the critical factors that contribute to the successful implementation of continuous auditing practices and investigate the significance of evaluating the maturity level of the auditing system to ensure optimal performance and outcomes.

Design/Methodology – The research methodology selected for this study is based on the design science methodology proposed by Wieringa (2014). This methodology consists of four phases, namely problem investigation, treatment design, treatment validation, and treatment implementation. For data acquisition, this study chose survey method through semi-structured interviews with both external and internal auditors to capture the essence, challenges, and the factors that lead to a successful continuous auditing implementation.

Findings – The findings of this thesis highlight the challenges faced in implementing continuous auditing, both from a theoretical and practical perspective. While several challenges mentioned in the theoretical literature align with the practical findings, additional challenges emerged during the practical investigation, including data accessibility, lack of guidelines for implementation, and defining the appropriate controls to minimize exceptions. Based on these challenges, a total of nine key success factors were identified and categorized into three main categories: business process requirements, organizational condition requirements, and technological requirements. These key success factors provide organizations with a structured framework for successful continuous auditing implementation. In addition, the majority of the experts emphasized on the importance of audit maturity level evaluation prior to the continuous auditing implementation, hence this study presented an audit maturity level evaluation based on CMMI framework to allow organization assessing their maturity level to the advised maturity level. Furthermore, a comprehensive guideline is proposed as the final artifact based on the derivation of these key success factors, serving as a practical resource for organizations aiming to effectively implement continuous auditing practices with the audit maturity level evaluation serves as the navigation at which stage that an organization should start when implementing continuous auditing in their environment.

Validation – Four participants, including two internal and two external stakeholders, were interviewed using a semi-structured interview approach. The findings indicated a high level of clarity and understanding of the key success factors and the proposed guideline. The participants acknowledged the alignment of the key success factors with the goals of continuous auditing and suggested the inclusion of "tone at the top" as an additional factor. While the proposed guideline was considered adequate, suggestions were made to enhance its comprehensiveness, such as incorporating a scorecard and introducing a review phase.

Keywords: Continuous Auditing (CA), Internal Audit, Key Success Factors, Guideline, Audit Maturity Level

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Chapter I

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1. Introduction

Aligning with the technological advancement and the complexity of business, organizations have encountered numerous challenges to effectively processing their financial statement in terms of accuracy, transparency, and reliability. This leads to the fact that conventional auditing is no longer sufficient to address the demands for timely identification of risks and exceptions.

In the traditional approach, financial reports were generated periodically, often several months after the actual events occurred (Rezaee, Sharbatoghlie, & Elam, 2002). Auditing in this context primarily involved looking backward, examining a snapshot of the reported numbers to assess their accuracy. However, it is often too late to have a significant impact on the decision-making process when it is time to conduct these audits (Coderre, 2008).

The idea of continuous auditing (CA) has emerged as a viable strategy to improve the effectiveness of auditing practices along with its quality. Continuous auditing (CA) is an automated (internal) audit aiming to have more efficient process in terms of time and cost by leveraging the power of technology. Research conducted by Deloitte testified that CA could bring tremendous benefits to an organization by improving risk and control assurance, increasing the level of risk mitigation for business risks, expanding the audit coverage with no to minimal incremental cost, shortening the audit cycles, and real-time control monitoring ("Continuous Monitoring and Continuous Auditing: From Idea to Implementation," 2010). It enables organizations to identify anomalies and potential risks in continuous manner so that prompt actions can be conducted.

Although the theoretical development of continuous auditing has been roaming around in academic environment with significant benefits to the organizations, yet only relatively small portion of enterprises have applied it to their entities (Klein Tank, Scherrenburg, & Veld, 2018). Numerous reasons have been presented in different studies, such as lack of thorough literature review in the form of experimental and empirical research ((Vasarhelyi, Alles, & Kogan, 2004); (Brown, Wong, & Baldwin, 2007)) and unfit information on the current state of continuous auditing in practice due to informal-conducted study by third parties (M. Alles, Vasarhelyi, Kuenkaikaew, & Littley, 2012).

Moreover, the success of continuous auditing initiatives is not solely dependent on the adoption of advanced technologies. It requires a holistic understanding of the key factors that drive the effectiveness of continuous auditing (Klein Tank et al., 2018). The identification of key success factors provides organizations with a structured guideline to successful continuous auditing implementation. Understanding and effectively addressing these factors are vital to harnessing the full potential of continuous auditing and deriving meaningful insights for decision-making.

In addition to the key factors, according to (P. Rikhardsson & R. B. Dull, 2016), continuous auditing cannot be implemented in all organizations as it has a certain prerequisite maturity level of internal control. The initial cost of setting up continuous auditing is also high as the companies should invest in hardware, software, and talent to operate (M. Alles, Brennan, Kogan, & Vasarhelyu, 2006). Furthermore, other means of additional pre-conditions, namely: low frequency of changes, continuous monitoring, and changeability of the organization should be considered when applying continuous auditing to an organization (Wiegerinck, 2019).

Based on these, this research aims to explore and examine the key success factors and the importance of audit maturity evaluation in the context of continuous auditing for organizations. The research focuses in identifying the critical factors that contribute to the successful implementation of continuous auditing practices. Additionally, it investigates the significance of evaluating the maturity level of the auditing system to ensure optimal performance and outcomes.

1.1. Research Objective

Aforementioned, continuous auditing leverages advanced technologies and data analytics techniques to provide real-time monitoring and analysis of financial transactions and controls. Most CA research were published under independent organizations such as the research conducted by (Deloitte, 2010); and study by (Vasarhelyi et al., 2004) also highlighted the absence of comprehensive experimental and empirical research in the existing literature on continuous auditing. Moreover, study by (Kogan, Alles, Vasarhelyi, & Wu, 2014) further emphasized the significance of combining scientific and practical evidence to guide the successful implementation of continuous auditing practices.

The objective of this research is to investigate the key success factors and the importance of audit maturity evaluation in the context of continuous auditing for organizations. The research aims to identify the critical factors that contribute to the successful implementation of continuous auditing practices and examine the significance of evaluating the maturity level of the auditing system to ensure optimal performance and outcomes.

1.2. Research Questions

As organizations strive to maintain a competitive edge in an the fast-changing market, they must also deal with the challenges of complying with increasing regulatory requirements and mitigating risks. Among the existing strategies, continuous auditing has emerged as one promising approach, which can provide organizations with real-time insight into their financial performance, and operational efficiency. However, the implementation of continuous auditing in industries has been met with various challenges that were identified through systematic literature review conducted prior to this research, including organizational resistance, lack of guidelines, and technical complexity. Based on the stated research objective stated in sub-chapter 1.1, the main research question for this research is formulated as:

- What are the key success factors and how does audit maturity evaluation impact the effectiveness and value derived from continuous auditing initiatives in companies?

The main research question is supported with several sub-questions, in the forms of both knowledge and design questions as following:

1. Sub RQ #1 (knowledge question): What is Continuous Auditing?

Motivation: This question aims to provide deeper understanding of continuous auditing and its concept. Organizations can have in-depth understanding to utilize continuous auditing to its potential for improving auditing processes, detecting anomalies in real-time, and providing timely assurance on financial information. This question will be answered in Chapter 2 for theoretical findings and Chapter 3 for practical findings.

2. Sub RQ #2 (knowledge question): What are the main challenges in implementing continuous auditing in organizations?
Motivation: This question aims to understand the specific challenges that organizations face when implementing continuous auditing can help to identify key areas of focus for developing a comprehensive guideline. This question will be answered in Chapter 2 for theoretical findings and Chapter 3 for practical findings.
3. Sub RQ #3 (knowledge question): What are the key factors for continuous auditing implementation?
Motivation: This question aims to identify and explore the key factors that are crucial for the successful implementation of continuous auditing. The goal is to gain understanding of the critical elements necessary for organizations to effectively adopt and integrate continuous auditing into their audit processes. This question will be answered in Chapter 2 for theoretical findings and Chapter 3 for practical findings.
4. Sub RQ #4 (design question): How can organizations effectively embed the key success factors and audit maturity level evaluation for continuous auditing in the implementation based on their specific needs?
Motivation: The objective of this question is to investigate how organizations can strategically and effectively incorporate the key success factors and audit maturity level evaluation for continuous auditing into their implementation process, considering their unique needs and requirements. It focuses on the development of a guideline that enable organizations to successfully embed the key success factors of continuous auditing and the importance of audit maturity level evaluation achieve improved audit effectiveness and efficiency. Chapter 4 will be dedicated to answer this question by synthesizing practical findings from expert interviews.
5. Sub RQ #5 (validation question): To what extent does the identification of key success factors and audit maturity level evaluation result in the effectiveness of continuous auditing implementation?
Motivation: The aim of this research question is to evaluate the effectiveness of the identified success factors and audit maturity evaluation in driving positive outcomes and enhancing the value of continuous auditing for organizations. This question will be discussed in Chapter 5 and the findings will be presented based on expert interviews.

1.3. Research Scope and Limitation

The scope of this research encompasses an exploration of key success factors and audit maturity evaluation within the context of continuous auditing in companies. The study aims to understand the concept of continuous auditing, identify the main challenges faced by organizations when implementing it, and examine the key factors necessary for successful implementation. Additionally, the research seeks to investigate the impact of audit maturity evaluation on the effectiveness and value derived from continuous auditing initiatives. It is important to note that the information and insights for this research are primarily obtained from expert interviews.

As for the limitation, the study assumes that there may be no direct contact with companies that have successfully implemented continuous auditing, failed in its implementation, or are reluctant to implement it, which could limit the availability and quality of data. The study will instead rely on data acquired from interviews with professional auditors who have worked with numerous clients on continuous auditing implementation.

Another limitation is that the study may be limited in its ability to identify and address all implementation key success factors and challenges related to continuous auditing, as the identified factors and challenges may be based on the experiences and perspectives of the interviewed auditors rather than a comprehensive analysis of the industry.

1.4. Research Methodologies

The research methodology serves as a paradigm for data collection and analysis, ensuring a systematic approach for research. It outlines the procedures and techniques that will be utilized to acquire and analyze the data, ensuring the reliability and integrity of the research findings.

For this study, the research methodology proposed by (Wieringa, 2014) was selected as the baseline. This approach was chosen due to the highlight on the importance of developing a conceptual model that is grounded in theory and is evaluated against the requirements. The model consists of four main steps, which are problem investigation, treatment design, and treatment validation, and treatment implementation. The problem investigation phase aims to gain in-depth understanding of the research problem and its context, as well as to identify the underlying causes and constraints that will inform the treatment design. The treatment design aims to address the identified problem by designing an innovative and practical treatment which can be in the forms of conceptual models such as modelling, simulation, or prototype. The next step is treatment validation which aims to test the validity, completeness, and feasibility of the conceptual model using rigorous validation techniques such as expert interviews. Once the treatment is validated, the final step would be treatment implementation where the final product is to be deployed into the real world. However, the treatment implementation phase is out of scope due to the time limitation. The illustrations of Wieringa's design science methodology can be seen in Figure 1.

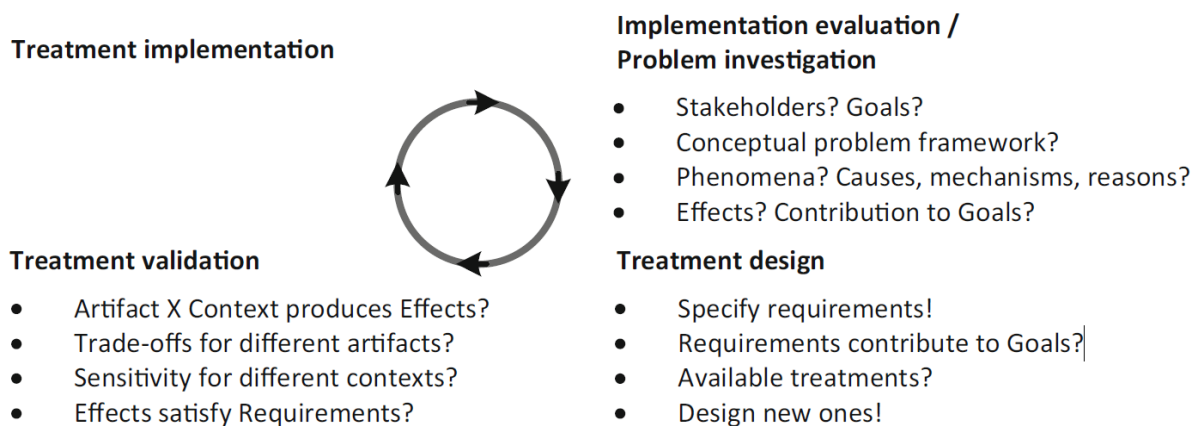


Figure 1. Design Science Cycle (R. J Wieringa, 2014)

1.5. Impact and Relevance

The study on key success factors and audit maturity evaluation in a company from a continuous auditing perspective holds significant impact for both practice and theory. This research aims to provide valuable insights and practical guidance for organizations seeking to enhance their auditing practices through the identification of the contributing factors to the successful implementation of continuous auditing and the evaluation of the maturity level of the auditing system. The study findings have the potential to guide the companies towards continuous auditing implementation, leading to improved effectiveness, efficiency, and value derived from auditing initiatives.

1.5.1. Practical Relevance

From a practical standpoint, this research has direct implications for organizations implementing continuous auditing. By identifying the key success factors, organizations can gain a structured framework to guide their continuous auditing implementation, enabling them to streamline their processes, enhance risk mitigation, and expand audit coverage. Moreover, the evaluation of audit maturity level helps organizations understand the readiness of their internal control systems and make informed decisions regarding resource allocation and technological investments. The practical impact of this research lies in its ability to empower organizations to make strategic choices that maximize the benefits of continuous auditing and improve their overall financial reporting accuracy and reliability.

1.5.2. Theoretical Relevance

Theoretical implications of this research are equally significant. By addressing the gap in the literature and providing a comprehensive understanding of key success factors and audit maturity evaluation in the context of continuous auditing, this study contributes to the theoretical development of continuous auditing practices. It enriches the existing body of knowledge by deepening our understanding of the factors that drive the effectiveness of continuous auditing initiatives. The findings of this research can serve as a basis for further theoretical exploration and refinement of continuous auditing frameworks, providing researchers with valuable insights to advance the field and facilitate future studies in continuous auditing practices.

In addition, numerous research ((M. Alles et al., 2006);(M. G. Alles, Kogan, & Vasarhelyi, 2008);(Singh, Best, Bojilov, & Blunt, 2014);(Vasarhelyi et al., 2004)) have been highlighted the needs to conduct in-depth studies on the implementation of continuous auditing in various fields.

1.6. Research Outline

The structure of this thesis on continuous auditing involves several chapters. Chapter 1 presents the background on key success factors and audit maturity level evaluation in organizations implementing continuous auditing, setting the stage for further investigation into their practical implications.

Chapter 2 presents a systematic literature study that synthesizes existing theoretical knowledge relevant subjects, addressing sub research questions 1-3 and providing a comprehensive understanding of the current state of research in this area.

Chapter 3 presents the practical findings obtained from expert interviews regarding key success factors and audit maturity evaluation in companies in the continuous auditing setting. Through in-depth interviews with industry experts, this chapter captures practical insights and experiences related to key success factors and audit maturity level evaluation in continuous auditing. It addresses sub research questions 1-3 from a practical standpoint, enriching the understanding of this topic in real-world implementations.

Chapter 4 of presents the design of a comprehensive continuous auditing guideline that is building upon the theoretical and practical findings to implement continuous auditing based on identified key success factors and audit maturity levels, while addressing sub research question 4.

Chapter 5 focuses on the evaluation of the proposed guideline obtained from the expert interviews. This chapter aims to validate and assess the applicability and effectiveness of the identified key success factors and the proposed guideline in the continuous auditing context.

Finally, Chapter 6 provides a conclusion, limitations of the study, and recommendations for future work in this research field. The illustration of the research structure can be seen in Figure 2.

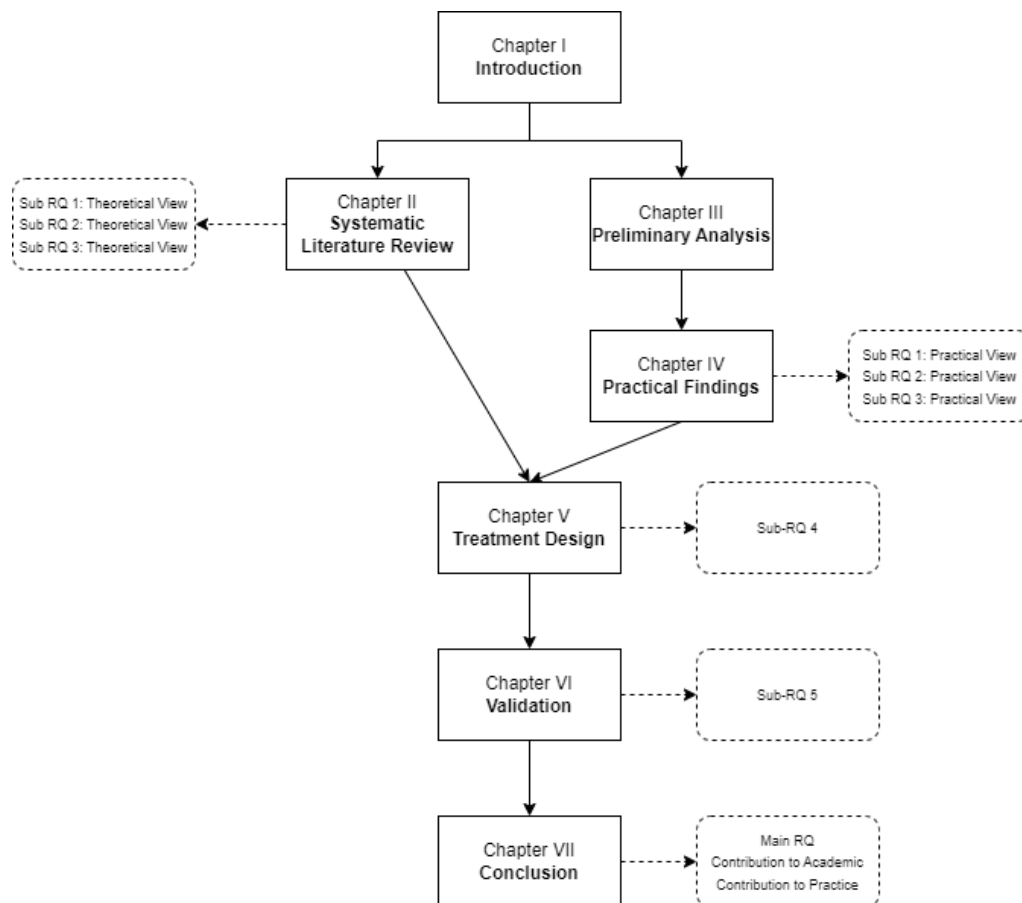


Figure 2. Research Structure

1.7. Summary

The introduction chapter sets the context for the research by highlighting the challenges organizations face in processing financial statements and the limitations of traditional auditing methods in addressing real-time risks and exceptions. It introduces continuous auditing (CA) as a promising approach that leverages technology to provide real-time monitoring and analysis, offering timely identification of risks and anomalies. The research objective is to explore key success factors and the significance of audit maturity evaluation in the context of continuous auditing. The chapter also outlines the research questions that will guide the investigation and explains the research scope and limitations. The selected research methodology, based on Wieringa's design science approach, is described, and its impact and relevance to both practice and theory are emphasized. The research outline provides an overview of the chapters, outlining the systematic literature review, practical findings from expert interviews, design of a continuous auditing guideline, and validation of the proposed guideline. The introduction chapter sets the stage for a comprehensive investigation into continuous auditing practices and its implications for organizations seeking to enhance their auditing processes.

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Chapter II

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2. Systematic Literature Review

Conducting a comprehensive literature review is a crucial step in the research process, as it allows for the exploration and assessment of relevant theories that can provide valuable insights and guidance to the researcher. According to (Wolcott, 2002), a literature review is a means to connect the current research with prior work and convey its research interests.

In this study, previous studies on conducting SLR by (Kitchenham et al., 2009) and (Bukhsh, Bukhsh, & Daneva, 2020) are the basis knowledge on the execution of this literature review. A comprehensive details of this systematic literature review is elaborated in following sub-chapters below.

2.1. Planning

When embarking on a systematic literature review, it is crucial to have a well-planned approach to ensure a comprehensive and rigorous analysis of the available research. The planning of this systematic literature review referred to research conducted by (Kitchenham et al., 2009). The details of the SLR planning are summarized in Table 1.

Table 1. SLR Planning

1. Planning	
1.1	Select Scientific Databases
1.2	Formulate Search Queries
1.3	Define Inclusion and Exclusion Criteria
2. Execution and Selection	
2.1	Execute Formulated Search Queries
2.2	Article Selection Based on Inclusion Criteria
2.3	Remove Duplicate Papers
2.4	Article Selection Based on Exclusion Criteria and Abstract
3. Result Analysis	
3.1	Extract and Analyze Papers According to Define Research Questions
3.2	Synthesize Result and Conclusion

2.1.1. Scientific Databases

For this research, three scientific databases are selected to obtain relevant academic publications and to answer the formulated research questions. The scientific databases selected for this systematic literature review are as follows:

- Scopus (<https://www.scopus.com>)
- Web of Science (<https://webofscience.com>)
- IEEE (<https://ieeexplore.ieee.org>)

The motivation of choosing these scientific databases is due to the good coverage of the relevant academic literature in the proposed topic. In addition, these scientific databases are also considered as the top five of most trusted academic resources databases.

2.1.2. Search Query Formulation

Constructing search queries to be executed on the scientific databases platforms is essential to obtain related works of this systematic literature review. These queries are derived through

selected keywords based on the formulated research questions, such as “success factors”, “business process”, and “framework”. In order to achieve precise keywords for the literature review, the synonyms of the main keywords are incorporated to the queries.

In initial attempt, a simple search query was executed with three main keywords “FINANCIAL” AND “CONTINUOUS” AND AUDITING. However, due to the insufficient materials, more complexed queries were formulated. The defined keywords for this literature review can be seen in Table 2.

Table 2. Search Query Keywords

CONTINUOUS AUDITING	KEY FACTORS	LAYERS	ARTEFACT
Continuous auditing	Success factors	Business process	Framework
Continuous	Requirements	Technology	Architecture
Audit	KPI	System	
	Key performance	Conditions	

Based on the categorized keywords presented in Table 2, the search queries were defined in accordance with the syntax and rules of each scientific database using logical operator “OR” and “AND. The more elaborated queries are stated below:

- **Scopus (advance search):**
 TITLE-ABS-KEY(
 (Continuous AND Auditing OR Audit)
 AND
 (Requirements OR implementation OR "success factors" OR "KPI" OR "key performance")
 AND
 ("business process" OR technology OR system OR conditions OR procedures)
 AND
 (Framework OR architecture))

- **Web of Science (advance search):**
 TS=(
 (Continuous AND Auditing OR Audit) AND (requirements OR implementation OR "success factors" OR "KPI" OR "key performance") AND ("business process" OR technology OR system OR conditions OR procedures) AND (framework OR architecture))
 OR

TI=(
 (Continuous AND Auditing OR Audit) AND (requirements OR implementation OR
 "success factors" OR "KPI" OR "key performance") AND ("business process" OR
 technology OR system OR conditions OR procedures) AND (framework OR
 architecture))

OR

AB=(
 (Continuous AND Auditing OR Audit) AND (requirements OR implementation OR
 "success factors" OR "KPI" OR "key performance") AND ("business process" OR
 technology OR system OR conditions OR procedures) AND (framework OR
 architecture))

▪ **IEEE:**

(Continuous AND Auditing OR Audit)

AND

(Requirements OR implementation OR "success factors" OR "KPI" OR "key
 performance")

AND

("business process" OR technology OR system OR conditions OR procedures)

AND

(Framework OR architecture)

2.1.3. Inclusion and Exclusion Criteria

(Kitchenham et al., 2009) have emphasized the significance of carefully establishing inclusion and exclusion criteria when conducting systematic literature reviews. These criteria serve as guidelines to ensure that only relevant studies are included in the review, while excluding those that do not meet the pre-defined standards. Such criteria are essential to maintain the integrity and validity of the review, and to prevent any potential biases that may arise due to the inclusion of irrelevant studies. For this systematic literature review, the inclusion and exclusion criteria are defined in Table 3.

Table 3. Search Query Keywords

Inclusion Criteria	Exclusion Criteria
Publications in English	Duplicate publications
Published in the last 10 years	Publications that are incomplete or unavailable
Study areas focusing on the field of Computer Science, Business Management & Accounting, and Auditing	Unrelated publications to the research questions from title, abstract, and contents

The inclusion criteria for this systematic literature review are set to any publications that are written in English and published in between the year of 2013 and 2022. An additional inclusion criterion is included to limit the domain of the research to obtain more specific and related papers to the topic. The reason behind the limitation of the publication year is due to the nature of auditing that is rapidly changing over the years so older publications may no longer be relevant to current trends of the topic.

Exclusion criteria is also established to ensure the relevancy of the literature reviewed for this research. All duplicate publications are removed along with incomplete and unavailable journals. The last exclusion criteria is unrelated publications to the topic based on their title, abstract or contents.

2.2. Selection

The result of query execution is presented in this section. The query execution was performed twice since there were two different queries that were used to find the relevant studies of the topic. The first executed query obtained a total of 181 literature results from three different scientific databases. The final number of the literature results from the executed query became 35 papers with only 13 full papers that are available to public.

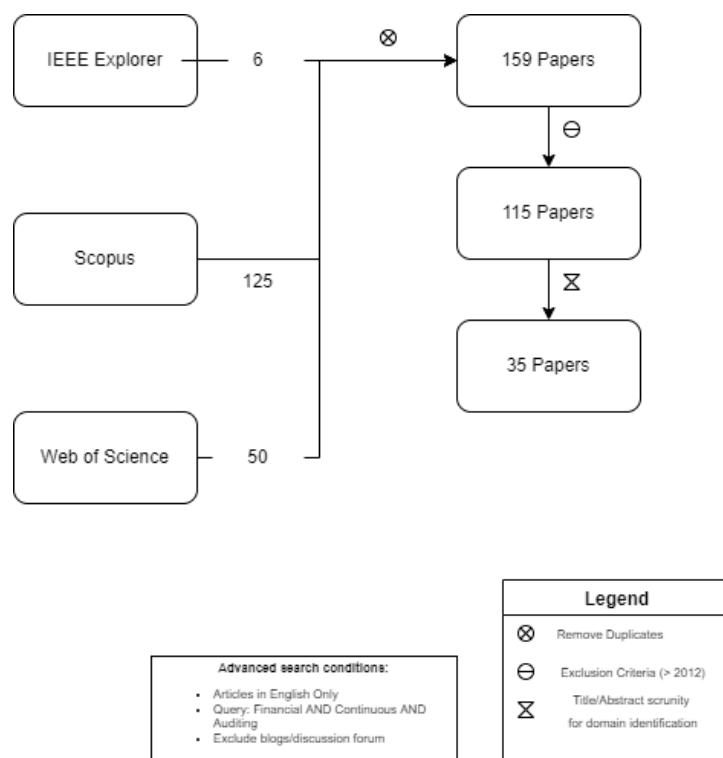


Figure 3. Initial SLR Selection Flowchart

After reading the available papers obtained from the initial query execution, the materials presented in the papers seemed to be insufficient to answer the formulated research questions. The second query was executed with more comprehensive keywords and obtained a total of 2.010 literatures before implementing both inclusion and exclusion method. As shown in Figure 4, the number of literatures was decreased to 234 publications after the inclusion criteria,

and it is reduced to 52 after applying the exclusion criteria. Based on the full text availability and the relevancy of it, the final number of selected literatures is 24.

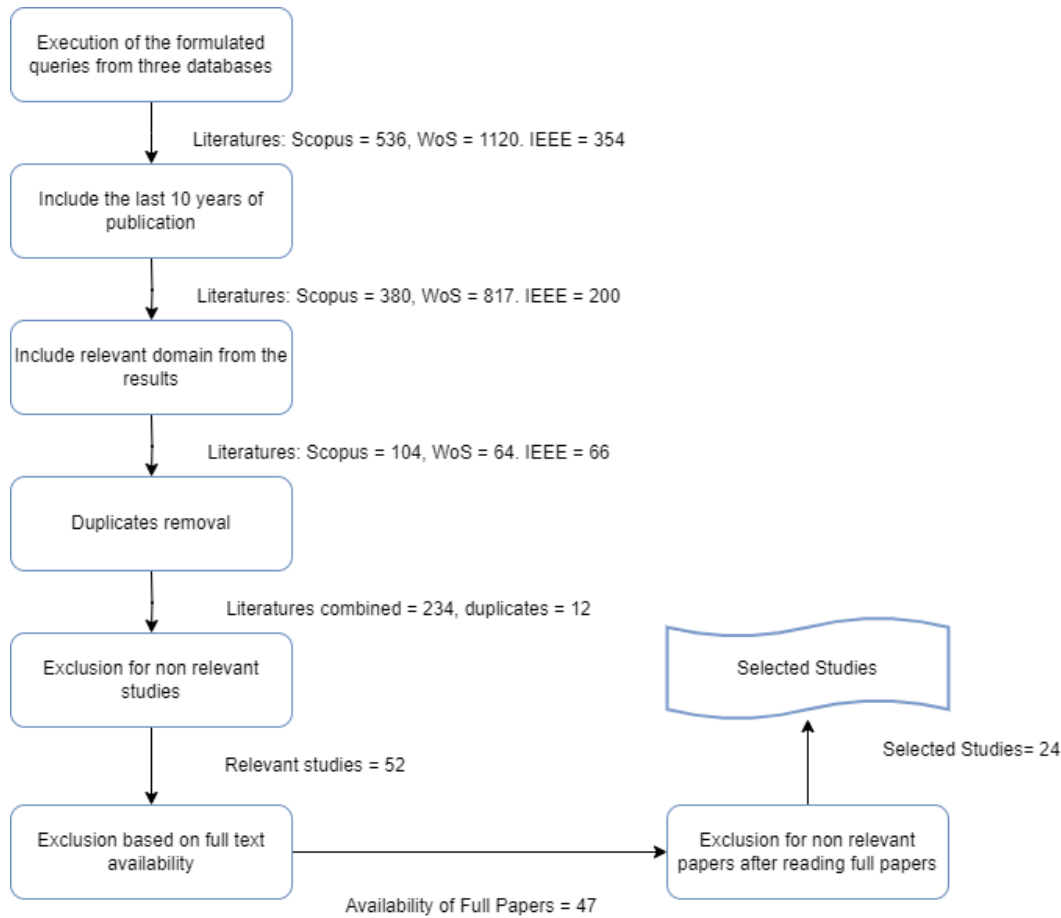


Figure 4. Final SLR Query Selection Flowchart

2.3. Result Analysis

2.3.1. Data Extraction

Data extraction was performed once inclusion and exclusion criteria were implemented to obtain the relevant literatures. For the research, the data extraction process will be divided into qualitative and quantitative analysis. The quantitative and qualitative analysis methods aim to provide a thorough understanding of the existing literatures.

2.3.2. Quantitative Analysis

Quantitative analysis for the research will be presented in two different tables which are categorized by the research purposes and the target. The target is classified to six categories, namely definition of continuous auditing (D), challenges in continuous auditing (C), key factors in continuous auditing (KF), technology and system maturity in continuous auditing (TS), business processes in continuous auditing (BP), and organizational conditions in continuous auditing (OC). The quantitative analysis of the literature reviews based on the target is summarized in Table 4.

Table 4. Quantitative Analysis Based on Target

No	Reference	Target					
		D	C	KF	TS	BP	OC
P1	(Sulistyowati et al., 2022)				v		v
P2	(Kuhn, Courtney, & Morris, 2014)						v
P3	(Sun, Alles, & Vasarhelyi, 2015)	v	v				v
P4	(Wang, Zipperle, Becherer, Gottwalt, & Zhang, 2020)				v		
P5	(P. Rikhardsson & R. Dull, 2016)				v		v
P6	(Tandiono & Federicco, 2022)	v			v		v
P7	{Li, 2020 #19}				v		
P8	{Ismail, 2015 #191}						v
P9	{Feung, 2020 #147}				v		
P10	{Van Hillo, 2016 #180}	v		v			
P11	{Cardoni, 2020 #139}		v	v	v		
P12	{Kiesow, 2014 #206}				v		
P13	{Subhani, 2015 #193}				v	v	
P14	{Yoon, 2021 #127}				v	v	
P15	{Joshi, 2020 #149}				v		
P16	{Singh, 2015 #192}				v		
P17	{Appelbaum, 2016 #186}				v	v	v
P18	{Hassan, 2023 #116}			v			
P19	{Kiesow, 2016 #189}		v		v		
P20	{Lins, 2018 #162}	v	v			v	
P21	{Mokhitli, 2019 #156}	v	v		v		v
P22	{Shin, 2013 #213}				v	v	
P23	(Ezzamouri & Hulstijn, 2018)	v		v	v	v	
P24	{Zhang, 2022 #118}				v		

2.3.3. Qualitative Analysis

Qualitative analysis methods for systematic literature review involve a more in-depth examination of the literature to identify common themes, patterns, and trends. For this systematic literature review, the qualitative analysis is presented in a table form based on the target set as shown in Table 4.

Based on the qualitative analysis, it can be extracted that continuous auditing is defined as a systematic approach that allows independent auditors to provide written assurance on specific subject matters by issuing a series of auditors' reports shortly after relevant events occur by several studies. It is also highlighted that the reason to the low adaption of continuous auditing is due to the tools in facilitating continuous auditing is still immature due to significant resource requirements, technical complexity, and security challenges.

In terms of the requirements of CA implementation, technologies like artificial intelligence, data mining, and big data paradigms play a crucial role in enabling continuous auditing, emphasizing the importance of information technology within the process, and defining business processes and organizational characteristics are essential for the successful initiation and implementation of continuous auditing. In short, the qualitative analysis provides insights into the challenges, benefits, and requirements for implementing continuous auditing, with a focus on technology, processes, and organizational factors. The qualitative analysis result is shown in Table 5 on Appendix section.

2.4. Answer to Research Questions

This sub-section presents the discussion on the findings to answer sub research question 1 – 3 from theoretical view.

- Sub-research question 1: What is continuous auditing? – *Theoretical View*

Continuous auditing is a systematic approach employed by organizations to deliver written assurance on a specific subject matter. This methodology involves the issuance of a series of auditors' reports that are generated either concurrently or shortly after the occurrence of events underlying the subject matter. It focuses on obtaining audit evidence and indicators from various systems, processes, transactions, and controls, collected on a frequent or continuous basis with the assistance of analytical technology tools. The process of continuous auditing allows auditors to monitor controls and risks, gather evidence using technology, and provide timely reporting on anomalies and recommendations. In other words, continuous auditing enables organizations to provide written assurance on a subject matter, with audit reports issued virtually simultaneously or in a prompt manner after the occurrence of events underlying the subject matter, while the entity's management retains responsibility.

- Sub-research question 2: What are the main challenges in implementing continuous auditing in organizations? – *Theoretical View*

One of main challenges in implementing continuous auditing in organizations lie in the substantial resources required to invest in continuous auditing initiatives. Implementing and maintaining the necessary IT infrastructure, including hardware, software, and analytical tools, can be costly. Additionally, the complexity involved in designing and managing IT systems to support continuous auditing poses a challenge.

Technical implementation challenges are also prevalent such as integration and interoperability of various IT systems and data sources within the organization. The complexity of designing and maintaining IT systems, the analysis of heterogeneous data, and the requirement for a diverse skillset. The shift from traditional auditing to continuous auditing also rises the challenge in the realization of continuous auditing since the auditors must understand how to adapt their procedures and methodologies to effectively assess controls, identify anomalies, and report on risks and exceptions in a continuous auditing context. The increased reliance on technology and the collection of large volumes of data also introduce new risks and vulnerabilities which challenge the organization to implement robust data security measures to protect against unauthorized access, data breaches, and manipulation of audit data.

- Sub-research question 3: What are the key factors for continuous auditing implementation?
– *Theoretical View*


There are several key success factors to be considered in implementing continuous auditing. These factors are divided into three categories, namely organizational conditions, technology, and business processes conditions which is mentioned in previous research by (Wiegerinck, 2019).

- **Organizational Conditions:** Organizational size is an important factor in determining the feasibility and impacts of continuous auditing. Smaller businesses may have limited resources and less complex operations, making the adoption of continuous auditing less crucial. However, larger organizations with established ERP systems and publicly regulated companies are more likely to benefit from continuous auditing due to the complexity of their operations and regulatory requirements. Moreover, the readiness of institutions must also be considered. The local regulatory environment, cultural attitudes towards technology and innovation, and availability of skilled personnel can impact the feasibility and success of continuous auditing implementation.
- **Technology:** Technology plays important role in realizing the continuous auditing since CA is highly dependent to it for automation, analytics, efficiency improvement, and many more. Another technology requirement mentioned in the previous studies is standardized data format. Since CA will have to deal with big data, having uniform data will likely improve the accuracy and effectiveness of the process.
- **Business Processes:** Defining business processes is a critical success factor in continuous auditing during initialization of the continuous auditing process. This is critical as it helps to identify and map the key business processes that require continuous monitoring and auditing.


2.5. Summary

The systematic literature review (SLR) provided valuable insights into the concept of continuous auditing, its main challenges in implementation, and key success factors. The review established that continuous auditing is a systematic approach employed by organizations to provide written assurance on a specific subject matter. It involves the issuance of auditors' reports generated either concurrently or shortly after the occurrence of underlying events, utilizing analytical technology tools to collect audit evidence and indicators from various systems, processes, transactions, and controls on a frequent or continuous basis.

Among the main challenges identified in implementing continuous auditing, the review highlighted the substantial resource investment required, technical challenges, and the shift from traditional to continuous auditing. Regarding key success factors for continuous auditing implementation, the review identified several key factors which are classified into three categories.

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Chapter III

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3. Research Data

This chapter sheds light on the data collection process, including case study overview and interviews conducted with key stakeholders, which serve as invaluable inputs to analyze and draw meaningful insights.

3.1. Case Study

This sub-chapter presents the case study conducted with two organizations: KPMG Netherlands, a global professional services firm, and a multinational Indonesian corporation. The case study serves as a foundation for developing practical recommendations and guidelines to optimize continuous auditing practices and enhance overall audit effectiveness. The insights gained from this case study will be further validated and integrated into the subsequent phases of this research.

In addition to the primary research objective, this chapter aims to address the following specific questions:

- What are the primary challenges faced by organizations during the implementation of continuous auditing?
- How is the continuous auditing process structured and executed in each organization?
- What are the critical elements considered in the continuous auditing framework of both organizations?

3.2. Case Study Overview

KPMG Netherlands, a prominent professional services firm, plays a central role in this research, providing valuable insights into continuous auditing practices from an external audit perspective. The multinational Indonesian corporation, on the other hand, offers essential perspectives as an entity implementing and utilizing continuous auditing internally. These organizations' collaboration allows for a comprehensive understanding of the dynamics and implications of continuous auditing in both an external audit service provider and an internal audit function within a multinational corporation. The diverse contexts and experiences of the two organizations enrich the case study and facilitate the identification of cross-industry best practices and key success factors in continuous auditing. Confidentiality agreements are respected, and all findings and data remain anonymized to protect the organizations' privacy and sensitive information.

The case study interview was a fundamental step in comprehending the challenges and opportunities associated with continuous auditing in both KPMG Netherlands and the multinational Indonesian corporation. This phase involved an in-depth examination of the current continuous auditing practices, potential pain points, and areas of improvement within each organization. The primary goal was to identify the key issues faced by both organizations and explore the effectiveness and implementation of continuous auditing practices.

In-depth semi-structured interviews were conducted with key personnel responsible for continuous auditing within each organization. The interviews were carefully designed by referring to some previous study and through discussion with several colleagues to explore various aspects of continuous auditing, including the auditing process, technology utilization,

challenges encountered, and the overall perception of continuous auditing's effectiveness within the organizations.

3.3. Data Collection

The sub-chapter on data collection presents the sources of data used in this research to gain comprehensive insights into key success factors and audit maturity level evaluation in the context of continuous auditing. The data were obtained through interviews conducted with two distinct groups of participants. The first group consisted of experts from an external auditing company, who provided their expertise and industry knowledge on continuous auditing implementation.

The second group comprised internal auditors from a large corporate organization in Indonesia, offering valuable perspectives from practitioners directly involved in implementing continuous auditing within their own organizations. This diverse range of sources ensures a well-rounded understanding of the subject matter and enhances the relevance and applicability of the research findings.

3.3.1. External Auditors

The data are obtained through expert interviews with external auditor who have experiences with continuous auditing. The interviews conducted with external auditors have yielded valuable insights into the concepts, implementation process, and tools associated with continuous auditing as they are coming from different backgrounds. The summary of external auditor experts background can be seen in Table 6.

Table 5. Summary of Expert Backgrounds

	Expert A	Expert B	Expert C	Expert D	Expert E
Department	IT Assurance & Advisory (Partner)	Financial Statement Audit (Senior Consultant)	Continuous Auditing Tools Product Owner (Manager)	IT Assurance & Advisory (Senior Manager)	GRC Technology & Control Integration (Senior Manager)
Experience					
<i>CA Implementation</i>					
<i>CA Article / Publication Contribution</i>					
<i>Auditing Experience</i>					
<i>GRC Experience</i>					

3.3.2. Internal Auditors

For the internal auditor interviews, two experts from an Indonesian company who were involved in the implementation of continuous auditing in their company. These additional interviews were conducted to gain more insights as they offered valuable firsthand experiences

and considerations specific to their organization in CA implementation. The summary of the internal auditors' background is shown in Table 7.

Table 6. Summary of Internal Auditors' Background

	Internal A	Internal B
Department	IT Auditor / Business Side of Continuous Auditing Implementation	IT Auditor / Product Owner/ Technology Side of Continuous Auditing Implementation
Experience		
<i>CA Implementation</i>		
<i>CA Article / Publication Contribution</i>		
<i>Auditing Experience</i>		

3.4. Interview Format and Analysis

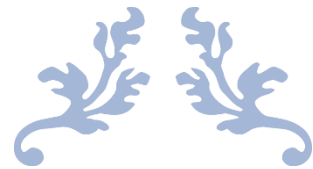
The data collection process for this study involved conducting interviews with participants who provided their informed consent to be recorded. The interviews were conducted in two languages, English and Bahasa, and the interview questions were categorized into three sections: introduction to continuous auditing (CA), validation of gaps, and CA implementation process. These questions were designed to be open-ended, allowing the interviewees to provide detailed information and insights on the topic.

Subsequently, the interview transcripts underwent a data analysis. Initially, an open coding process was employed to systematically categorize and label the raw data, capturing the initial themes and patterns that emerged from the interviews. This process involved thoroughly examining the transcripts to identify meaningful units of information and assigning descriptive codes to them.

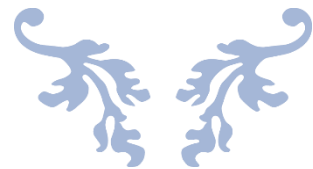
Following the open coding phase, axial coding was utilized to making connections between the identified codes and exploring both the differences and similarities within the data. It enables a deeper understanding of the relationships between categories, properties, and dimensions within the dataset to answer the research questions.

3.5. Summary

The research data chapter provides a comprehensive overview of the case study overview, data collection process and interview format employed to gather practical insights from both external auditors and internal auditors. The data collected from expert interviews offer valuable perspectives on continuous auditing implementation, and the interviewees' diverse backgrounds enrich the research findings. The interview analysis was conducted using open and axial coding techniques, enabling the identification of meaningful themes and patterns in the data. This systematic analysis enhances the depth and relevance of the research findings, contributing to a more comprehensive understanding of continuous auditing in practice.



Chapter IV



4. Practical Findings

The Practical Findings chapter presents the results obtained through interviews conducted with external and internal auditors to gather insights on the success factors of continuous auditing. Two separate interviews were conducted with external auditors, and an additional interview was conducted with internal auditors. The interview framework was carefully developed in the form of semi-structure open-ended interview based on various sources and was consulted with two colleagues who possess a background in auditing, and the data collected were analyzed to provide a comprehensive understanding of the practical aspects of continuous auditing implementation.

A two-step coding process was employed: open coding and axial coding to ensure a rigorous and systematic analysis of the interview data. During the open coding process, the interview transcripts were examined and labelled into several themes and patterns, which then processed using axial coding method to see the relation between the data then grouping them into categories to have deeper understanding of the relationships between different factors and their impact on continuous auditing practices. The summary of the interview result is presented in Table 8, while the full interview questionnaire can be seen in Appendix section.

Table 7. Interview Result

Interviewees: ►	Expert A	Expert B	Expert C	Expert D	Expert E	Internal A	Internal B
Topics: ▼							
Sub RQ 1:							
Definition and Purpose							
Real Time Monitoring							
Relationship with Continuous Monitoring							
Sub RQ 2:							
Technological Infrastructure							
Data Quality & Availability							
Organizational Culture and Resistance to Change							
Stakeholder Alignment							
Knowledge Gap or Exception Rules							
Budget Allocation							
Sub RQ 3:							
Clear Objectives and Scope							
Change Management Strategy							
(Business) Process Design and Alignment							

Audit maturity or Technology Infrastructure							
Human Competencies							
Organizational Condition							
Control Selection							
Stakeholder Engagement							

4.1. Introduction of Continuous Auditing

According to the experts, Continuous auditing is a proactive approach that puts the client in greater control of the auditing process. Continuous auditing provides a more controlled audit environment by facilitating the early detection of exceptions. This means that any deviations or irregularities can be identified and addressed promptly, rather than waiting for an interim period or the completion of the entire audit cycle.

At its core, continuous auditing focuses on identifying exceptions from a large pool of data. By leveraging technology and data analytics, it enables auditors to efficiently and effectively sift through vast amounts of information to pinpoint any anomalies. Moreover, continuous auditing allows for the spreading of the audit workload throughout the year, ensuring that the process is ongoing and not limited to specific periods. Ultimately, continuous auditing empowers organizations with real-time control over their financial numbers, as it facilitates the instant gathering of audit evidence, leading to a more accurate and timely assessment of their financial processes and controls.

Although continuous auditing offers great advantages to organizations, implementing continuous auditing in an organization can pose several challenges. One challenge is defining controls based on the specific area of agreement between auditors and the business or client, which can result in a low number of exceptions. Obtaining data from various environment in high frequency is another challenge, as it requires ensuring there are no false positive exceptions that would require extensive manual checks and potential revisions to the entire continuous auditing system settings. Additionally, due to the customized nature of business processes, implementing continuous auditing requires significant resources and effort.

Another significant challenge is the need for a cultural change within the organization to adapt to the new way of working. Continuous auditing introduces a shift in daily work practices, necessitating a readiness on the part of the client to embrace and implement the continuous auditing approach. This readiness is influenced by factors such as the maturity level of the organization, the state of mindset towards embracing change, and the investment required for implementing continuous auditing. Furthermore, majority of the experts mentioned that there is no existing guideline in implementing continuous auditing, hence they relied on their past audit experience as reference.

4.2. Key Success Factors

The key success factors were derived based on findings from both expert interviews and theoretical literature. These factors aim to help the organizations to focus on aspects that can lead to a successful implementation of continuous auditing. The key success factors were categorized into three, namely organizational condition requirements, technological

requirements, and business process requirements. These categories are structured based on their importance of the implementation.

4.2.1. Organizational Condition Requirements

Organizational condition requirements are considered as the most fundamental aspect in successful implementation of continuous auditing in an organization since the abandonment of the key success factors in this category would result in not only in no implementation of continuous auditing system, but in no initiation or planning of continuous auditing implementation. Based on the findings, successful implementation of continuous auditing practices requires careful consideration of organizational condition requirements, which are:

Tone of the Top Management:

Tone of top management plays a pivotal role in the success of continuous auditing. When top management demonstrates strong support and enthusiasm for implementing continuous auditing practices, it fosters a culture of engagement and encourages employees to embrace the new approach. On the other hand, a disengaged or indifferent tone from top management can undermine the effectiveness of continuous auditing efforts, resulting in missed opportunities to strengthen internal controls and address potential risks proactively. Therefore, top management's positive and committed tone is essential for creating an environment conducive to the successful implementation of continuous auditing practices.

Logic example: Imagine Company X, a multinational corporation, decides to implement continuous auditing to enhance its internal controls and risk management practices. The top management, including the CEO and board members, actively promotes the adoption of continuous auditing as a strategic initiative. They allocate sufficient financial resources to invest in advanced auditing technologies and provide training for employees to develop the necessary skills. The CEO frequently communicates the importance of continuous auditing in ensuring transparency and safeguarding the company's assets. As a result, employees across different departments feel motivated and supported in embracing the changes brought about by continuous auditing.

Talent:

The professional availability is essential for the successful implementation of continuous auditing practices. Skilled professionals possess the expertise and knowledge required to effectively utilize continuous auditing techniques such as proficient in data analytics, internal controls, risk management, and auditing methodologies. Skilled professionals are crucial in ensuring that the continuous auditing process is efficient and effective, leading to improved risk management and internal control effectiveness.

Logic example: Imagine company A has experience professionals in internal audit, risk management, and information technology department, however they have no talent in data analytics department, and they thought that they are ready in implementing continuous auditing with just overlook one department expertise. In the process of implementing rules to set up parameter or indicator to identify the pattern of anomalies, they rely on the basic knowledge of information technology department. When they check the auditing report, they noticed that their system is failed to derive meaningful insights and address potential risks.

Good Change Management Strategy:

Implementing continuous auditing practices requires a well-defined change management strategy to address the challenges associated with organizational change. Resistance to change is a natural response, and it can hinder the adoption and effectiveness of continuous auditing initiatives. Therefore, a structured change management approach is essential to overcome resistance and promote a smooth transition.

A change management strategy typically includes several key components. First, it is important to clearly communicate the need for and benefits of continuous auditing to all stakeholders within the organization. This involves highlighting the advantages of continuous auditing in terms of improved risk management, enhanced control effectiveness, and increased efficiency. By effectively communicating the rationale and value proposition, organizations can gain buy-in and support from stakeholders, making them more receptive to change.

Another crucial aspect of the change management strategy is involving stakeholders throughout the implementation process. This includes engaging key individuals from different departments, such as IT, audit, finance, and operations. By involving stakeholders from the early stages, organizations can tap into their expertise, address concerns, and ensure that their perspectives and needs are considered. This collaborative approach fosters a sense of ownership and commitment among stakeholders, increasing the likelihood of successful adoption and sustained usage of continuous auditing practices.

Change management also involves providing the necessary training and support to employees to build their capabilities and confidence in utilizing continuous auditing techniques. This may include training programs, workshops, and ongoing support to ensure that individuals have the knowledge and skills required to effectively perform their roles in the continuous auditing process.

Logic example: Imagine Company A wants to implement continuous auditing, but they failed to effectively communicate the purpose and benefits of continuous auditing to the employees and only letting them know when it is already deployment phase which leads to confusion and employee resistance to change. With the change resistant, the continuous auditing system fails to achieve the initial goals as the employee fails to manage to operate it effectively.

Organizational Size:

The size of an organization can significantly impact the challenges faced in implementing continuous auditing. Larger organizations often have more complex business processes, diverse systems, and a higher volume of data to analyze. Implementing continuous auditing in such organizations may require additional resources, infrastructure, and coordination. The complexity of the organization's operations and the diversity of its systems may necessitate customized approaches to adapt continuous auditing techniques effectively.

On the other hand, smaller organizations may face challenges related to limited resources and capacity to adopt and sustain continuous auditing practices. They may have fewer dedicated personnel available for continuous auditing efforts and limited IT infrastructure to support the process. Smaller organizations may need to prioritize specific areas of concern and allocate resources accordingly.

Understanding the organization's size is crucial in tailoring continuous auditing approaches to meet its specific needs and challenges. For larger organizations, it may involve developing scalable solutions, coordinating efforts across departments and business units, and ensuring proper data integration. Smaller organizations may focus on leveraging available resources effectively, maximizing the use of existing technology, and implementing continuous auditing practices in a more targeted manner.

Logic example: Imagine Company A lacks awareness in their organization's size and complexity when they are in the process of implementing continuous auditing, not knowing that they have very complex business processes. This results in the absence of the holistic view of their operations which lead to the struggles in prioritizing the areas for continuous audit focus.

4.2.2. Technological and Audit Maturity Level Requirements

Technological and audit maturity level requirements can be considered as the second most important aspect in continuous auditing implementation since effective implementation of continuous auditing heavily relies on robust technological capabilities. Drawing from the findings, four factors emerge as the key to the success of continuous auditing, namely audit and system maturity, data accessibility and collection capabilities, ETL and big data storage capabilities, and data analysis and IT infrastructure.

Audit Maturity Level:

The maturity level of audit function is one of the critical factors affecting the successful adoption of continuous auditing. An organization's audit function maturity refers to the level of professionalism, independence, and effectiveness of the internal audit department. A mature audit function has clear roles and responsibilities, well-defined processes and methodologies, and a strong risk-based approach to auditing.

When the audit function is mature, the organization is better prepared to implement continuous auditing successfully. The audit function can leverage its expertise and knowledge to design and execute continuous auditing procedures effectively. Mature systems provide a solid foundation for data extraction, data analytics, and automation, supporting the seamless integration of continuous auditing into the organization's operations.

Logic example: Imagine Company A with a compliance-based audit approach want to implement continuous auditing. A compliance-based audits typically focus on verifying adherence to specific regulations, standards, or policies. These audits are conducted periodically and do not provide real-time insights into the company's operations or potential risks. It is opposed with the concept of continuous auditing which highlights the real-time control and analysis to gain insights into the company's internal control effectiveness, risk management, and operational efficiency. If the company does not aware of their audit maturity level, there is a high possibility to experience failure in implementing continuous auditing.

Data Accessibility and Collection Capabilities:

Easy access to relevant data, and efficient data collection is vital for conducting continuous auditing activities efficiently. Data accessibility and collection ensures that organizations can retrieve necessary information promptly.

Organizations need timely access to relevant and accurate data. This requires establishing data repositories or data warehouses where all relevant data from various systems and sources can

be consolidated and accessed easily. Data accessibility also involves defining clear data ownership, data custodianship, and access controls to ensure data security and privacy.

As for data collection, it involves capturing and gathering relevant data from various sources within the organization. This may include transactional data, financial data, operational data, log files, or external data sources. Efficient data collection mechanisms ensure that the required data is captured in a timely manner and with minimal errors or omissions.

Logic example: Imagine in company A, their data collection is still performed manually with limited access to all the required data to implement continuous auditing, so the company relies on manual processes for data collection from multiple sources such as point-of-sale systems, inventory databases, and financial records which takes effort and high risk of human errors resulting in inefficiencies and false exceptions when they analyze the data in the continuous auditing system.

ETL and Big Data Storage Capabilities:

Effective Extract, Transform, Load (ETL) processes are crucial for transforming raw data into a usable format for continuous auditing. Additionally, employing appropriate data analysis techniques and algorithms enhances organizations' ability to detect irregularities, uncover patterns, and identify risks more efficiently.

During the extraction phase, organizations need to identify the relevant data sources and retrieve the necessary information. This may involve extracting data from databases, spreadsheets, log files, or other sources within the organization. The extracted data is then transformed to ensure consistency, standardization, and compatibility with the auditing tools and techniques being used. Transformation processes may include data cleaning, filtering, aggregation, and enrichment.

Once the data is transformed, the data needs to be stored securely and efficiently. Proper data storage solutions should be in place to handle the volume of data generated by continuous auditing activities. This may involve using databases, data warehouses, or cloud-based storage solutions. The storage system should provide data integrity, confidentiality, and availability while allowing auditors to retrieve and access the data whenever needed. It is loaded into a target system or database where it can be analyzed. The target system should have the necessary storage capacity, data structures, and indexing capabilities to efficiently handle the volume of data generated by continuous auditing activities. This enables organizations to perform data analysis, apply algorithms, and generate meaningful insights.

Logic example: Imagine that Company A only have the capabilities of manual data extraction and transformation and does not have huge capacities for database server and start in implementing continuous auditing where the data are collected in real time and from various source with different format of data. data collection is primarily performed manually, requiring employees to gather data from various sources such as point-of-sale systems, inventory databases, and financial records. Without mature ETL capabilities, their input data will be too inconsistent that would impede the system ability in detecting risks and analyzing data comprehensively.

Data Analysis and IT Infrastructure Capabilities:

Data analysis is a key component of continuous auditing which involves implementing various techniques to extract meaningful insights from the collected data. Organizations can use data analysis tools and visualization techniques to identify patterns, anomalies, and potential risks. A good data analysis capabilities enable organizations to efficiently process and interpret large volumes of data, leading to more accurate and timely risk identification and mitigation. This empowers them to uncover hidden risks, identify process inefficiencies, and provide valuable insights to the organization's management for decision-making and improving internal controls.

Additionally, a robust IT infrastructure involves having reliable hardware, software, and networking capabilities to facilitate data extraction, data analytics, and reporting. The IT infrastructure should be scalable to handle large volumes of data and capable of integrating with different systems and technologies used in the organization.

A reliable IT infrastructure ensures that continuous auditing activities can be performed efficiently and without disruptions. It supports the automation of audit tests and procedures, enables real-time monitoring and reporting, and facilitates the exchange of information between auditors and relevant stakeholders.

Logic example: Imagine that Company A wants to implement continuous auditing by leveraging machine learning with big data input without having any sufficient data analysis and IT infrastructure capabilities such as computational power. Throughout the time, their continuous auditing system will suffer from constant failure and will face struggles in performing advance analytics to identify any anomalies.

4.2.3. Business Process Requirements

In continuous auditing implementation, certain business process requirements must be met to ensure its practical implementation and effectiveness. This category is considered as the least out of the most important aspects due to high important role that the other two aspects held as stated previously. Based on the findings, two key factors that significantly impact the success of continuous auditing are data and process harmonization/standardization, as well as accurate determination of risks and controls associated with the auditing activities.

Data Standardization and Process Harmonization:

Consistency and standardization of data and processes across the organization play a significant role in the success of continuous auditing. Harmonizing processes and standardizing data streamline auditing activities, ensuring accuracy and reliability in the continuous auditing process.

Data harmonization involves aligning data formats, definitions, and structures across different systems and departments within the organization. When data is standardized, auditors can easily compare and analyze information from various sources, improving data quality and reducing inconsistencies. This consistency facilitates the application of data analytics techniques and enables auditors to identify patterns, anomalies, and trends more effectively.

Similarly, process harmonization refers to aligning business processes and workflows across the organization. Standardized processes ensure that similar activities are performed consistently, reducing variations, and enhancing control effectiveness. It also enables

organizations to develop standardized audit procedures that can be applied uniformly across different areas of the organization.

Organizations can streamline their continuous auditing activities by harmonizing and standardizing data and processes. They can develop standardized audit tests and procedures that can be automated and applied consistently, leading to more efficient and effective audits. It also improves the comparability of audit results over time and across different business units, enabling organizations to identify trends and areas for improvement more accurately.

Logic example: Company A is a multinational company where the internal processes and data from each department lack of standardization and they want to implement continuous auditing right away. When the CA system is ready, they found that there are too many false positives in the exceptions and anomalies in the auditing reporting. The absence of standardization and process harmonization led in the inconsistency and discrepancies in the data analysis which hindered the organization's efforts to achieve operational efficiency and transparency by implementing CA.

Good Risk Assessment and Control Selection:

Risk assessment is a fundamental component of continuous auditing, providing the foundation for identifying and addressing potential risks that could impact the organization's objectives. It involves systematically evaluating the likelihood and impact of risks and determining appropriate risk response strategies.

Continuous auditing relies on the identification and assessment of risks to determine the focus and scope of auditing activities. By conducting a thorough risk assessment, auditors can allocate their resources effectively, prioritize areas of higher risk, and design appropriate audit procedures and tests. This proactive approach helps in identifying control gaps, detecting emerging risks, and providing timely insights to management for informed decision-making.

Accurate determination of necessary controls and identification of risks associated with continuous auditing activities are key factors in successful implementation, hence organizations need to have a clear understanding of the risks that exist in their operations. Risks can arise from various factors such as internal control weaknesses, fraud, regulatory compliance, technological vulnerabilities, or operational inefficiencies.

The first step is conducting a comprehensive risk assessment. This involves assessing the organization's internal and external environment, identifying potential risks, and measuring their potential impact on the business objectives. Once the risks are identified, organizations need to define the mitigating controls to manage these risks effectively.

Control determination involves designing and implementing controls that are tailored to address the identified risks. These controls can be preventive, detective, or corrective in nature, and they should be aligned with the organization's risk appetite and objectives. Auditors need to consider various factors such as the control's effectiveness, efficiency, cost, and feasibility during the control determination process.

The accurate determination of necessary controls and identification of risks allows auditors to establish a robust framework for continuous auditing. This framework helps in proactively

monitoring and assessing controls, identifying control gaps or weaknesses, and taking corrective actions promptly.

Logic Example: Imagine Company A has risk register with faulty risk level and flawed automated control selection and implement them in continuous auditing system. When the CA system translates them, it leads to vulnerabilities and leaves the critical areas exposed. As a result, resources were misallocated, key risks were overlooked, and the company faced heightened financial and operational risks. In the end, the company suffers financial losses, regulatory penalties, and damaged stakeholder trust.

4.2.4. Audit Maturity Level Assessment

As previously mentioned, assessing the audit maturity level is an important factor in continuous auditing implementation. The importance of this factors has been highlighted by the majority of the experts.

Due to no specific methodology in assessing the maturity level of an organization mentioned during the interview, organization can use the Capability Maturity Model Integration (CMMI) framework as a reference to assess its maturity level. The Capability Maturity Model Integration (CMMI) Framework is a set of best practices and guidelines designed to improve organizational processes and capabilities in a company. This framework is chosen due to its comprehensive and standardized approach in assessing an organization's process maturity that also support process improvements (Sudiantara, Sudarma, & Widyantara, 2021). CMMI provides a structured model that helps organizations identify their strengths and weaknesses in various domains, including auditing practices. The audit maturity consists of five distinct levels: initial, managed, defined, quantitatively managed, and optimizing.

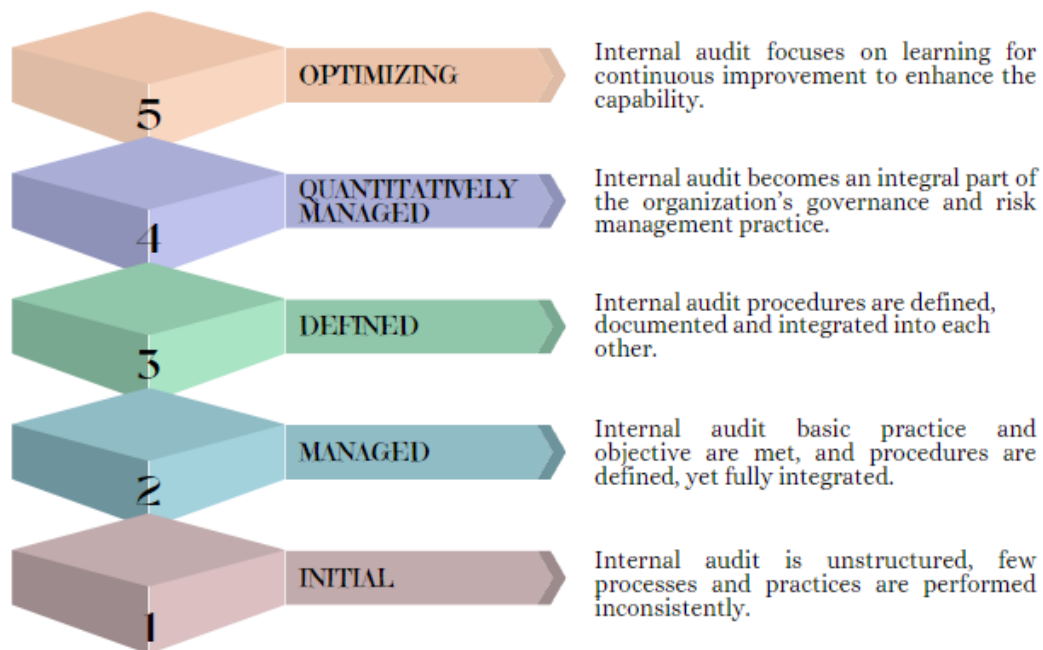


Figure 5. Audit Maturity Level based on CMMI Framework

Initial:

At the initial stage, the auditing processes within an organization are typically disorganized and lack formal risk assessment, control, or audit procedures. The environment is unstable, characterized by rapid and undocumented changes to the business processes. As a result, the outcomes of the operations are unpredictable and cannot be effectively measured or replicated. Success primarily relies on the competence of individuals rather than the existence of robust systems.

Managed:

At this stage, organizations exhibit increased focus in their audit and basic objectives are met. Emphasis should be placed on data quality and process maturity. The availability of tools and resources for internal control activities is still limited, and the organization continues to depend on the expertise of a small number of specialists. While the organization can provide some evidence of their internal control design, it is not yet fully established or integrated into their operations.

Defined:

Organizations at this level have established more formalized auditing processes, resulting in greater consistency in processes and their outcomes. Consequently, the organization is capable of substantiating not only the design of their internal control but also the operational effectiveness of these controls.

Quantitatively Managed:

Organizations at this level have more established and sophisticated business processes. Metrics are developed to measure process effectiveness and guide development plans. In this stage, organization entails to shift from traditional auditing to continuous auditing by continuously test and report on their internal control processes.

Optimizing:

At this level, organization has the capability to monitor day-to-day business operations and to continually seek new ways to improve, with the ultimate objective of enabling business excellence. This means the organization can their focus from continuous auditing to continuous monitoring.

Based on the maturity level criteria by CMMI framework, it is highly suggested for an organization to reach at least maturity level 4 to start implementing continuous auditing in their environment. This is due to the requirements of having harmonious data and processes, as well as good internal controls as highlighted by both experts and previous studies.

After conducting validation interviews with the experts, a scorecard was developed to help organizations assess their audit maturity level. The scorecard was designed based on the characteristics defined by the Capability Maturity Model Integration (CMMI) framework, ensuring a structured and comprehensive approach to evaluating audit maturity. One of the experts specifically requested the development of this scorecard to provide organizations with a practical tool to determine their audit maturity level effectively.

Organization can assess their audit maturity level through scorecard evaluation. A sample scorecard has been developed based on the characteristics defined by the Capability Maturity Model Integration (CMMI) framework to help organizations in determining their audit maturity level. The scorecard sample can be seen in Table 9.

The scorecard provides a structured approach to evaluate the organization's audit maturity level across various dimensions. It encompasses four categories, which are business process assessment, data quality assessment, Test of Design (ToD) and Test of Effectiveness (ToE) aspects, and audit planning, reporting & communication. This scorecard was also inspired by a study about internal audit CMMI checklist conducted by (Ebrahim, 2023).

Table 8. Scorecard Sample for Audit Maturity Level Assessment

		DATE	ORGANIZATION NAME		
		AREA	CURRENT LEVEL	TARGET LEVEL	NOTES
BUSINESS PROCESS ASSESSMENT	Adequate process documentation (e.g., process maps, SOPs)			4	
	Standardization of processes across the organization			4	
	Existence of internal controls framework			4	
	Identification and assessment of risks within business processes			4	
	Implementation of risk mitigation measures			4	
	Regular monitoring and evaluation of process performance			4	
DATA QUALITY ASSESSMENT	Existence of data governance policies and procedures			4	
	Clear roles and responsibilities for data management			4	
	Defined data collection processes and sources			4	
	Integration of data from various sources			4	
	Consistency and standardization of data formats and structures			4	

	Transformation and cleansing of data to ensure consistency		4	
ToD AND ToE ASPECTS	Evaluation of the design effectiveness of internal controls		4	
	Evaluation of the effectiveness of internal control activities		4	
	Alignment of controls with business objectives and risks		4	
	Integration of controls within business processes		4	
	Identification and assessment of risks within business processes		4	
	Implementation of risk mitigation strategies and controls		4	
	Integration of data analytics and automation into auditing activities		4	
	Level of assurance provided by internal controls		4	
	Identification and assessment of risks within business processes		4	
AUDIT PLANNING, REPORTING, AND COMMUNICATION	Well-defined audit program with clear objectives and scope		4	
	Alignment of audit plan with identified risks and priorities		4	
	Use of performance metrics to measure and enhance audit quality		4	
	Effective communication between auditors, auditees and stakeholders		4	
	Timely and accurate audit reporting to management and stakeholders		4	
	Clear and concise audit findings and recommendations		4	
	Responsive and effective follow-up on audit recommendations		4	

1	INITIAL	No formal processes or practices in place.
2	MANAGED	Some processes and practices exist but are not consistently followed.

3	DEFINED	Processes and practices are defined and followed to some extent.
4	QUANTITATIVELY MANAGED	Processes and practices are well-established and consistently followed.
5	OPTIMIZING	Processes and practices are optimized and continuously improved.

Each aspect in the scorecard is assigned a scoring range, typically from 0 to 5, allowing for a quantitative assessment of the organization's maturity level. Based on the scores obtained, the organization can determine its audit maturity level according to the defined CMMI framework characteristics, which include Initial, Managed, Defined, Quantitatively Managed, and Optimizing levels.

Organizations can gain insights into their current audit maturity level and identify areas for improvement through this assessment to help them understand their strengths and weaknesses, enabling them to develop strategies and action plans to enhance their audit practices and achieve higher levels of audit maturity to the point that the organizations have reached the advised level for continuous auditing implementing.

4.3. Answers to Research Questions

This sub-section presents the discussion on the findings to answer sub research question 1 – 3 from the practical view.

- Sub-research question 1: What is continuous auditing? – *Practical View*

Continuous auditing is an approach that leverage technology to provide a more controlled audit environment. It offers a real-time auditing and monitoring of the business activities and controls of an organizations and allows the organizations to identify exceptions or anomalies in their environment in early time, rather than to make them wait until the interim period to be addressed properly.

- Sub-research question 2: What are the main challenges in implementing continuous auditing in organizations? – *Practical View*

Some of the challenges derived from the expert interviews are align with the ones mentioned in practical, such as data standardization, business process harmonization, data collection, and change reluctance.


Apart from the mentioned above, additional challenges are identified from practical findings such as defining controls based on the specific area of agreement between auditors and the business or client, which can result in a low number of exceptions, and to minimize the number of false positive exceptions that would require extensive manual checks and potential revisions to the entire continuous auditing system settings. In addition, all the experts mentioned that there is no guideline in implementing continuous auditing, so they must rely on their past experience instead.

- Sub-research question 3: What are the key factors for continuous auditing implementation? – *Practical View*


Based on the practical findings, there are nine key success factors identified which are classified into three categories namely, technological requirements, business process requirements, and organizational condition requirements. Same as the challenges, several key success factors are aligned with the ones that have been discussed in previous studies. In technological perspective, an organization should take into account their audit maturity level, data accessibility and collection capabilities, ETL and big data storage capabilities, and data analysis and IT infrastructure capabilities. As for organizational condition requirements, organizational size, talent, and change management strategy are the critical factors in the implementation of continuous auditing. Last but not least, from business process requirements aspect, data standardization and business processes harmonization, as well as risk assessment and automated control selection are the ones that the company should focus on.

4.4. Summary

The practical findings of the research shed light on the implementation of continuous auditing from a real-world perspective. Continuous auditing is recognized as an approach that leverages technology to create a controlled audit environment, enabling real-time monitoring and identification of exceptions in an organization's activities and controls. Several challenges in implementing continuous auditing were identified, including data standardization, business process harmonization, and change reluctance. Additionally, defining controls based on agreement between auditors and clients can lead to a low number of exceptions and the need to minimize false positives. The lack of guidelines for implementation also poses a challenge. Nine key success factors were identified, categorized into technological, organizational, and business process requirements. These factors include audit maturity level, data accessibility and collection capabilities, organizational size, talent, and change management strategy, as well as data standardization, risk assessment, and automated control selection. The practical insights provided valuable guidance for the proposed guidelines and framework, supporting successful continuous auditing implementation.

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Chapter V

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5. Treatment Design

In previous chapters, the challenges and key success factors, as well as audit maturity level assessment have been presented from both technical and practical point of views. In this chapter, the key success factors are embedded into a continuous auditing guideline to serve as reference for organizations with the audit maturity level evaluation as the navigator for the company to determine where they should start.

5.1. Continuous Auditing Guideline

Implementing a continuous auditing system is a complex and resource-intensive task that involves significant effort and investment. The process encompasses various stages, starting from initial preparations and extending to the actual execution of the system. As evidenced by Internal B from a notable company, it took them more than eight years to successfully implement a continuous auditing system within their organizational environment from scratch.

To effectively guide organizations in this implementation journey, this research will provide comprehensive insights into the step-by-step process that organizations at maturity level 1 can adopt based on the key success factors and audit maturity level assessment presented in previous sub-chapter. It aims to address the specific challenges encountered in the organizations, such as the lack of detailed documentation on their data and business processes as mentioned in both theoretical and practical findings.

The guideline of continuous auditing is categorized into three phases, which are exploration and preparation, implementation, and sustainability or post-implementation. This guideline is inspired by the EPIS framework. The Exploration, Preparation, Implementation, Sustainment (EPIS) framework is a comprehensive framework used in implementation science and program evaluation. This framework was chosen due to its simple but systematic approach to the entire process (Houghtaling, et al., 2023).

The exploration and preparation phase of continuous auditing implementation aims for organizations to lay the foundation for a successful and effective continuous auditing program. This phase involves gaining a deep understanding of the organization's data and business processes, mapping the business processes and data, assessing risks, defining the audit program, top risk and automated control selection, and parameter or indicator definition.

The implementation stage of continuous auditing is where the vision and plans developed in the exploration and preparation phase come to life. It involves executing the necessary steps to acquire data, perform data transformation and analysis, manage alerts, verify findings, and generate reports. This stage is critical as it sets the continuous auditing system into operation, enabling auditors to detect anomalies, identify potential risks, and provide valuable insights to enhance the organization's internal control environment. Effective implementation requires the deployment of appropriate tools, integration with existing systems, and adherence to defined processes and procedures. During the implementation stage, there may be some overlap with the last steps of the exploration phase as the defined parameters and collected data are evaluated for suitability in the system. This can result in iterative steps and back-and-forth adjustments to ensure a seamless transition between the two phases.

Once the continuous auditing system is implemented, organizations enter the post-implementation phase, which focuses on sustaining the effectiveness and value of the continuous auditing program. This stage involves user acceptance testing to ensure that the system meets user requirements and expectations, conducting regular reviews to identify areas for improvement, and providing comprehensive end-user training. The continuous evaluation of the system's performance, having to address any identified deficiencies and ensuring that users are equipped with the necessary skills and knowledge, organizations can maximize the benefits of continuous auditing and ensure its long-term sustainability. The illustration of the whole process of continuous auditing is shown in Figure 6.

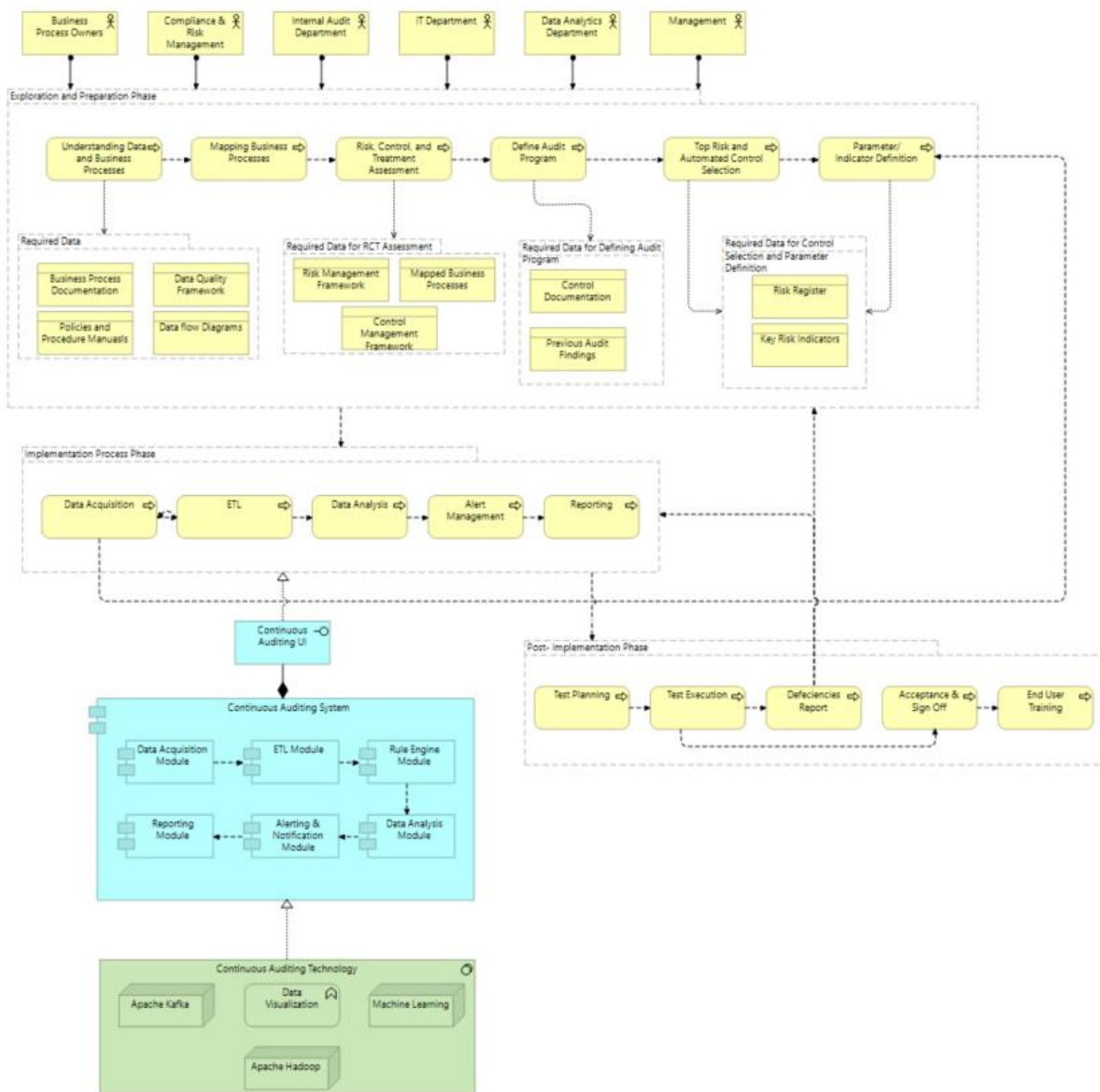


Figure 6. CA Implementation Guideline

5.1.1. Exploration and Preparation Phase

As mentioned in the previous chapter, an organization is strongly advised to assess their maturity level and ensure that they are at least at the third level. In this exploration and

preparation phase, a set of processes are defined for an organization to reach the minimum maturity level prior to develop continuous auditing system in their environment.

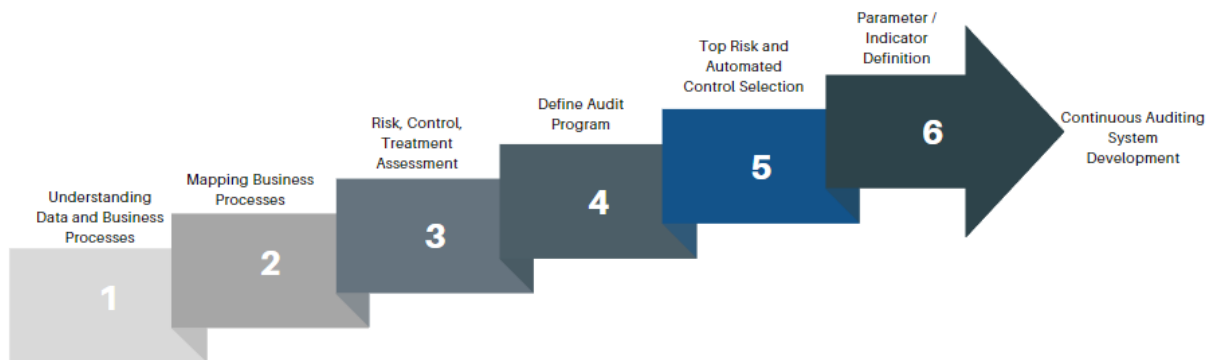


Figure 7. Pre-implementation Phase Guideline

Understanding Data and Business Process

According to Internal A and Internal B, before implementing continuous auditing, it is essential to have a comprehensive understanding of the organization's data and business processes. The goal of this process is to specify the key activities of the company that will be implemented in the continuous auditing system as well as to identify relevant data sources that the organization have or requires to have.

According to (Microsoft, 2022), there are two main tasks to realize this stage: (1) Define the objectives by collaborating with all stakeholders to understand and identify the business problems and formulate questions that define the business goals that continuous auditing can improve, and (2) Identify data sources to find relevant data that define the objectives of continuous auditing implementation.

As an example, a banking organization wants to have an objective in streamlining their operations by identifying opportunities for optimization, automation, and digitization to improve operation efficiency. Then from the defined objective, some questions to define business goals to achieve the objective can be formulated as follows:

1. How to streamline the account opening process to enhance customer experience?
2. What steps can be taken to automate and digitize manual processes within the operations to improve efficiency?

The next process will be collecting and reviewing process manuals, standard operating procedures, data dictionaries, system documentation to see area of improvement. Conducting interviews with relevant stakeholders about the data flows, business processes, or systems can serve as additional approach to gather more information to realize this phase.

The people responsible for conducting a thorough analysis of the organization's data business processes are business analyst or process analyst with the collaboration with multiple stakeholders such as department heads or business process owners to gain in-depth understanding of the business processes and the associated data.

This process is derived from the key success factors of: (1) talent, (2) change management strategy, and (3) organizational size. This is due to the requirement of (1) having experienced

employees with expertise in the relevant department such as risk management, audit department, and IT department, (2) the involvement of the whole relevant department to gain in-depth understanding of their business processes and data, (3) understanding the condition of their operation procedure and complexity.

Mapping Business Processes

Once the stakeholders acquire in-depth understanding of the data and business processes, organization should perform process mapping to gain a holistic view of its operations which can serve as a reference in identifying control points and potential risks. Business process mapping involves visually representing the flow of activities, inputs, outputs, and decision points within an organization's processes. It provides a clear understanding of how different processes are interconnected and enables identification of potential control points and areas for improvement.

An effective process mapping is characterized by its simplicity and ability to depict the sequence and interactions of a process (Boudreaux, 2010). It encompasses several key elements that contribute to its clarity and comprehensibility. These elements include inputs, core processes, interactions represented by arrows, outputs, and support processes. Additionally, a well-designed sub-process within a larger map ensures alignment between inputs and outputs of the parent map and establishes consistency with the inputs of the subsequent process map.

For business processes mapping, a company can use visualization tools such as BPMN, flowchart, or ArchiMate. Each business process should have clear and concise flows of the entire activities. This process falls to the responsibility of business process architect with the help of business analyst to map the business processes effectively.

As mentioned in the previous step, the organization is planned to understand the business process and data to answer the defined question of how to streamline the account opening process to enhance customer experience. Hence, the organization needs to map the business process of new account opening procedure. The sample of the business process mapping for opening new bank account can be seen in Figure 8. This mapping process was adapted from (Banking Industry Architecture Network, n.d.).

Opening a new bank account process involves several steps to ensure a smooth onboarding for customers. It starts with the bank receiving and verifying the new account request, where the authenticity and completeness of the application are checked. Then the bank reviews the submitted documents to ensure that all required paperwork is obtained. In the event of missing documents, the bank promptly notifies the customer and requests them to provide the missing information. Once all the required documents are available, the bank proceeds with the document verification process.

During the document verification step, the bank assesses the validity and accuracy of the submitted documents. Once the documents are approved, a check will be conducted whether the applicant is a new or existing customer. If the new account is requested by an existing customer, the bank retrieves the customer's information from the existing database. The bank shall have to input the customer's details if the applicant is a new customer.

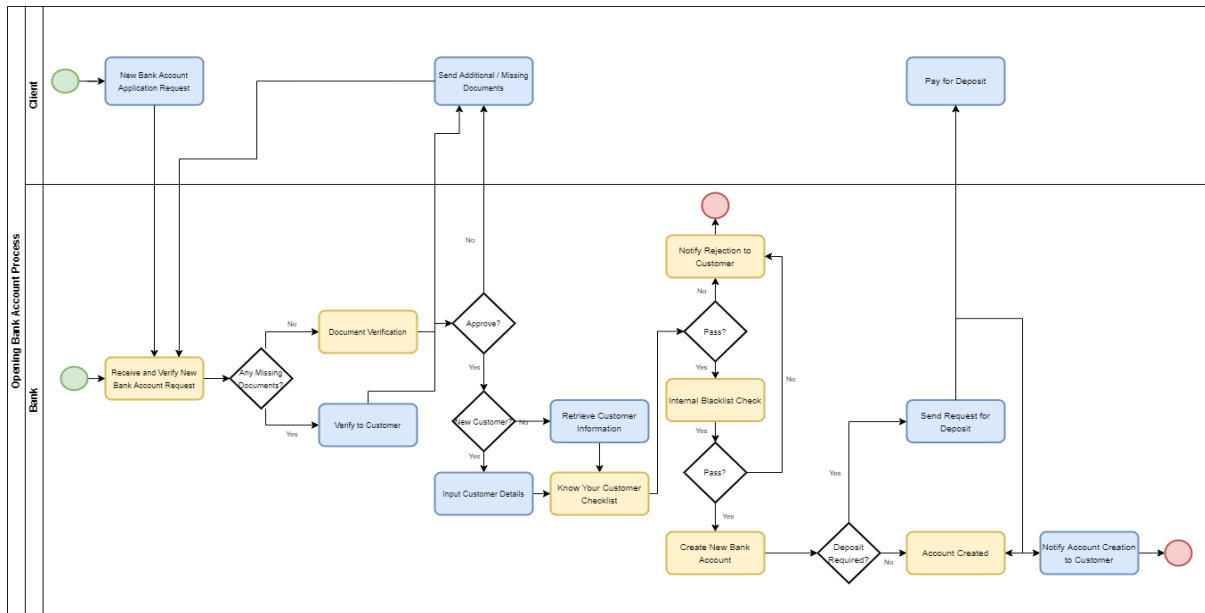


Figure 8. Business Process Mapping of New Account Opening

The process continues to the Know Your Customer (KYC) checklist, where the bank thoroughly checks the customer data to ensure compliance with regulatory requirements. If the applicant successfully passes the KYC checklist, the bank proceeds to check if the customer is listed in the internal blacklist. If the customer does not pass the KYC or is found on the internal blacklist, the bank notifies them of the rejection.

For customers who pass both the KYC checklist and internal blacklist checks, the bank proceeds to set up the account agreement. Once the agreement is established, the bank checks whether any initial deposit is required. If a deposit is mandatory, the customer is notified and provided with the payment details. In contrast, if no deposit is required, the bank proceeds to create the new account. Once all processes are cleared, the bank notifies the customer that their account has been successfully created, completing the new bank account opening process.

Mapping business process is derived from identified key success factors of audit maturity level and business process harmonization as it facilitates process standardization, supports risk assessment, enables process optimization, and promotes consistent auditing practices. It serves as a fundamental tool for organization to understand, evaluate, and improve business processes, which leads to enhancing the effectiveness and efficiency of continuous auditing.

Risk, Control, and Treatment Assessment

Once the business processes have been mapped, it is crucial for organizations to assess the risks associated with each process to ensure effective risk management and control implementation. The risk, control, and treatment assessment allow organizations to prioritize their focus on high-risk areas and define the appropriate controls needed to address those risks. It helps in establishing a risk-based approach to continuous auditing implementation. Risk manager or internal auditor will lead the risk and control assessment process with the cooperation from relevant departments to identify and establish control measures and risks.

The assessment can be realized through 5 steps in line which aligns with standards such as ISO 31000 and most risk analysis textbooks such as *An Introduction to The Basics Of Reliability*

And Risk Analysis(Zio, 2007), which are risk identification, risk assessment, risk prioritization, risk implementation, and risk evaluation.

The first step is to identify the risks associated with a specific business process. As defined previously, there are several steps in the new bank account processes and each process should be defined for its risk to be identified and documented.

Once risks are identified, they are assessed in terms of their potential impact and likelihood. The root causes and potential impacts of each risk are defined, and if applicable, risks are quantified using techniques such as risk scoring or risk matrices. Additionally, controls are defined or evaluated to determine their effectiveness in mitigating the identified risks.

After assessing risks, they are prioritized based on various factors such as their potential impact on business objectives, stakeholders' concerns, and the organization's risk appetite. This prioritization helps in determining which risks require immediate attention and allocation of resources for effective risk management.

Then, the controls are implemented to mitigate the identified risks. Controls can be preventive, detective, or corrective measures designed to reduce the likelihood or impact of risks. The business side takes responsibility for executing and maintaining the controls within the specified time frame, ensuring they are effectively embedded into the processes.

The final phase is evaluation that involves an iterative process of monitoring, reviewing, and evaluating the implemented controls. Regular assessments are conducted to determine whether the controls are functioning as intended and effectively mitigating the identified risks. This evaluation helps in identifying control weaknesses, gaps, or areas for improvement. In continuous auditing environment, the evaluation process will be taken over by the system as it will assess the effectiveness of control automatically. An example of risk and control assessment can be seen in Figure 13 in the appendix section.

The risk and control assessment will serve as a reference for the next processes, which involve define audit procedures and parameter/indicator definition for the controls. In CA context, the evaluation will be conducted in the implementation phase once the parameters are defined and embedded to the continuous auditing system and subsequently evaluated by the system itself. These parameters define the criteria against which the system will monitor and assess the effectiveness of controls and identify potential risks or anomalies. The evaluation process involves setting up thresholds, benchmarks, or rules that the system will use to detect control failures or deviations from expected behaviour. This allows the system to continuously evaluate and monitor the organization's control environment based on the predefined parameters and provide alerts or reports when necessary.

Risk, control, and treatment assessment is derived from identified key success factors of audit maturity level and good risk assessment and control selection since the more mature the organization, they strive to establish a more systematic and structured approach to risk management and control. This includes conducting comprehensive risk assessments and implementing robust control frameworks. The risk, control, and treatment assessment process is a reflection of the organization's maturity in understanding and managing risks, and it aligns with the goals of continuous auditing.

Define Audit Procedures

Defining the audit procedures is the next step in the continuous auditing pre-implementation process. An audit program refers to a detailed plan or set of instructions that outlines the specific procedures, steps, and tasks to be performed during audit. It serves as a roadmap for auditors, providing guidance on how to conduct the audit effectively and efficiently. The audit manager, along with Internal Auditors will be in charge in defining the specific audit procedures.

According to aware (Aware, 2020), there are six aspects to be determined in designing audit procedures, which are (1) audit approach, (2) level of assurance to be derived from audit procedures, (3) nature of audit procedures, (4) timing of auditing procedures, (5) extent of audit procedures, and (6) design efficient audit procedures.

When defining the audit procedures, organizations consider the organization's specific needs, objectives, and risks. They identify the scope of the audit, determining the areas, processes, or systems that will be subject to audit. This helps in focusing audit resources and efforts on high-risk areas and areas of significance. The result sample of audit procedures can be seen in Figure 14 in the appendix section.

Define audit procedures is derived from identified key success factors of audit maturity level since the more mature the organization, the organization will recognize the need for standardized audit procedures to ensure the effectiveness and efficiency of their auditing activities.

Automated Control Selection

Based on the risk assessment and audit program, organizations can identify the top risks that can be addressed through automated controls. These are the critical areas where continuous auditing can provide significant value in terms of real-time monitoring and detection of anomalies or deviations.

Through careful selection of automated controls, organizations can streamline the auditing process, reduce manual effort, and focus resources on highest risk areas as the evaluation of these controls can be taken over by the continuous auditing system. This enables organizations to provide timely insights and recommendations to management.

Automated control selection is derived from identified key success factors of audit maturity level and good risk assessment and control selection because as organizations progress in their audit maturity, they aim to enhance the efficiency and effectiveness of their control selection processes by automating as much as controls that they can. The management and Data Analyst, supported by Internal Auditors, are responsible for selecting and implementing automated controls in the organization's systems and processes.

Parameter / Indicator Definition

Defining parameters or indicator is the final phase of the pre-implementation process of continuous auditing. It involves setting thresholds or benchmarks for acceptable performance or behaviour within the processes. Parameters help in establishing the expected range of values, quantities, or outcomes and they define situations that deviate from the norm and require attention. This process falls to the responsibilities of data analyst and IT auditor.

By defining parameters or exceptions, organizations can automate the audit process and focus on detecting and investigating potential anomalies or non-compliant activities. This allows for a more efficient and effective continuous auditing system.

Clear definitions of parameters enable organizations to establish criteria for evaluating process performance and identifying potential control failures. The sample of parameter definition can be seen in Figure 9. As shown in Figure 9, the sample aims to determine any employees that have not gone through the mandatory training, which are reflected in the Training Status field, marked as “No”. The parameter is defined by checking whether the training field date of each employee is empty or not. If the field date is empty, hence the employee has not been trained yet.

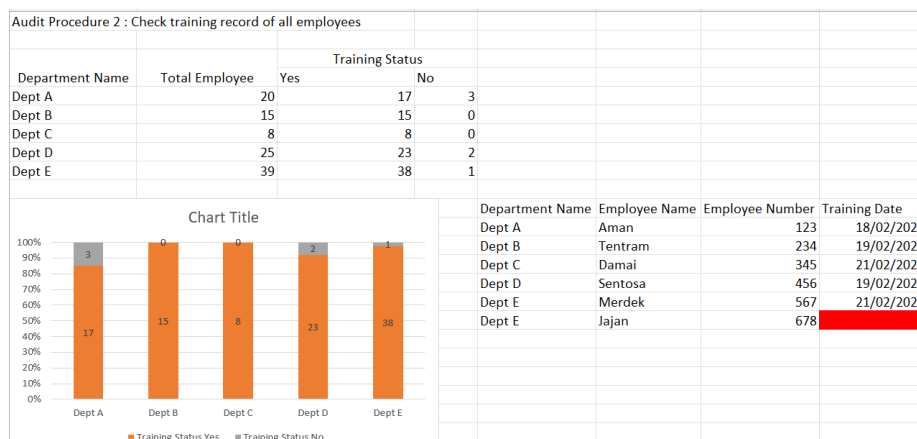


Figure 9. Parameter Definition Sample

5.1.2. Implementation Phase

The implementation phase will begin once the pre-implementation phase has been completed. This phase focuses on the development of continuous auditing system and consists of five main processes, namely data collection, ETL, data analysis, alert management, and reporting. The system requirements presented in this guideline are adapted from previous study by (Codesso, Silva, Vasarhelyi, & Lunkes, 2018) and (Klein Tank et al., 2018).

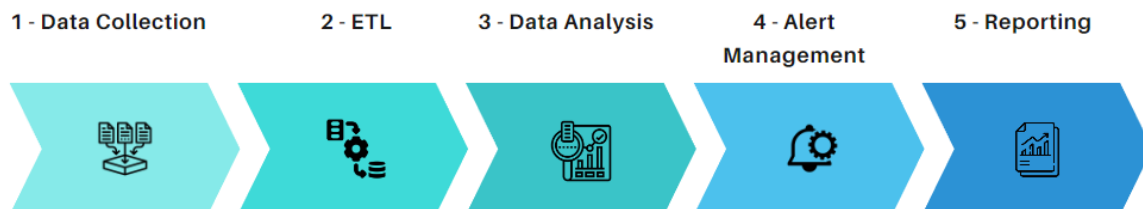


Figure 10. Implementation Phase

Data Collection

Data collection is a fundamental step in continuous auditing. It involves gathering relevant data from various sources, such as transactional systems, databases, or external sources. The data collected should be comprehensive, accurate, and relevant to the processes being audited.

According to(Li, Feng, & Li, 2020), there are three methods to data collection: (1) direct acquisition through cloud platform system, (2) complete seamless connection with the cloud platform which can be realized through API, and (3) obtain relevant data to audit from outside the organization.

As illustrated in Figure 6, this phase is advised to be supported by technology such as high-performance computing server to allow real-time acquisition. This step is derived from the key success factors of data collection and accessibility.

Data analyst will be responsible to oversee this process, ensuring data accuracy and completeness which in collaboration with IT department to acquire the data from various sources.

ETL

Once the data is collected, it needs to be processed and transformed through Extract, Transform, and Load (ETL) processes. This ensures that the data is standardized, cleansed, and ready for analysis. ETL processes help in creating a consistent and reliable data foundation for continuous auditing and is derived from key success factors of ETL and Big Data Storage capabilities, data standardization, and data analysis and IT infrastructure.

According to(Codesso et al., 2018), data format standardization is the most complex process in continuous auditing implementation. XBRL is strongly advised to be chosen as the data format for continuous auditing system as it serves as a globally recognized standard for representing financial and audit data.

Data engineer is the person-in-charge for ETL process to design and implement data transformation to acquire unified processed data to allow better data analysis for the next process.

Data Analysis

Data analysis is a core component of continuous auditing which is derived from data analysis and IT infrastructure capabilities. It involves applying analytical techniques and algorithms to the collected data to identify patterns, trends, anomalies, or potential risks. Data scientist and data analyst are responsible for these processes to establish technique and to embed algorithm to the system to extract insights, identify patterns, and detect anomalies in the data.

The implementation of algorithmic capabilities allows for automation and efficiency in data analysis. It enables organizations to identify exceptions or abnormal behaviours in real-time and trigger appropriate actions or alerts through the parameter or indicator set in the pre-implementation process.

According to Expert A, process mining can be leveraged to search the patterns for anomalies or exceptions in the data. An example of simple basic rules that can be implemented into continuous auditing system can be seen in Figure 11. The rules aim to identify any employees that have not completed training by checking the completion date field as defined in the parameter definition sub-section.

```

function checkTrainingRecord(employee):
  if employee.trainingCompletionDate is empty:
    return "Employee has not been trained."
  else:
    return "Employee has completed training on " + employee.trainingCompletionDate

function generateAlert(message):
  print("ALERT: " + message)

```

Figure 11. Rules Definition Sample

Alert Management

Alert management phase involves evaluating the effectiveness of the implemented continuous auditing system and is derived from data analytics and IT infrastructure capabilities. It includes assessing the quality of the outputs and alerts generated from the system.

The alert management can be in the form of a dashboard where organization can review, prioritize, and track alerts. It should possess the ability to customize alert criteria, adjust parameter, or add new rules as per the organization's specific needs.

It also requires regular monitoring and evaluation of the module's performance ensure its effectiveness in capturing meaningful alerts while minimizing false positives. This process falls to the responsibilities of internal auditor or risk manager. They should assess the alert or anomalies identified by the system to determine whether it is real issue and determine the appropriate actions to deal with it. Organizations can identify opportunities for optimization, refine control parameters, and enhance the overall effectiveness and efficiency of continuous auditing from this process.

Reporting

Reporting is the final phase in the implementation step. It focuses on generating timely, accurate, and comprehensive reports. It consolidates and synthesizes the data collected from various sources within the auditing framework, transforming raw information into meaningful insights and actionable findings, and it usually include visualizations such as graphs, tables, and charts to enhance the claritrz4y and effectiveness of the presented information.

5.1.3. Application and Technology in Implementation Phase

Figure 6 showcases the system architecture, which is represented by the blue and green elements, recommended for the implementation of Continuous Auditing (CA). The architecture consists of several modules that are designed to address the key success factors identified for successful CA implementation.

- **Data Collection Module:** This module is responsible for gathering relevant data from various sources such as databases, files, or APIs. It ensures efficient and automated data collection to support continuous auditing activities.
- **ETL Module:** The Extract, Transform, Load (ETL) module is essential for processing and transforming raw data into a consistent and standardized format. It performs functions like data mapping, cleaning, and integration, ensuring data quality and compatibility across different systems.

- **Data Analysis Module:** The Data Analysis Module employs advanced analytics techniques to extract insights and identify patterns or anomalies within the collected data. It leverages machine learning technology to automate analysis processes and detect potential risks or control weaknesses.
- **Rule Engine Module:** The Rule Engine Module incorporates rule-based algorithms or logic to evaluate data against predefined rules or criteria. It helps in assessing risks, identifying control gaps, and highlighting exceptions that require further investigation.
- **Alerting Module:** The Alerting Module plays a vital role in monitoring and notifying auditors about critical events or deviations from established norms. It enables real-time alerts and notifications to ensure timely response and intervention when anomalies are detected.
- **Reporting:** The Alerting Module plays a vital role in monitoring and notifying auditors about critical events or deviations from established norms. It enables real-time alerts and notifications to ensure timely response and intervention when anomalies are detected.

These modules are supported by technology such as database and network servers which provide the necessary infrastructure for data storage, accessibility, and connectivity. The database server technology enables efficient storage and retrieval of audit-related data, while network server technology ensures secure and reliable communication between different system components.

Machine learning technology is integrated into the data analysis process, enhancing the system's ability to automate complex analysis tasks, detect patterns, and predict future trends or risks. Furthermore, the architecture emphasizes data visualization capabilities to generate user-friendly reports that effectively communicate audit results and findings to auditors and other stakeholders.

The architecture aligns with the identified key success factors, enabling organizations to improve data accessibility, data analysis and IT infrastructure, and data standardization and process harmonization.

5.1.4. Post-Implementation Phase

During the post-implementation phase, the focus shifts towards ensuring a smooth transition and optimal utilization of the newly implemented system. One crucial step is to conduct user acceptance testing and in-house training. This phase aims to test the system, ensuring that it meets the user requirements and functions as intended, as well as providing comprehensive training to employees equips them with the necessary skills and knowledge to effectively utilize the system's features and functionalities.

User Acceptance Testing

Before fully deploying the continuous auditing system, user acceptance testing should be performed. This process aims to test the system's functionalities, performance, and usability to ensure that it meets the organization's requirements. For the UAT, IT department should be responsible with the whole process to design the test scenarios and manage the execution of the test.

During user acceptance testing, key stakeholders and end-users participate in validating the system's effectiveness and identifying any issues to provide feedback for improvement. This

iterative process helps in fine-tuning the continuous auditing system to ensure its alignment with the organization's needs.

According to (Leung & Wong, 1997), there are six test elements for user acceptance test which are elaborated in Table 9.

Table 9. UAT Elements

Test Elements	Details
Test Objective	A demonstrative test to evaluate the system's readiness for use. Test major functions and interface, and common exceptions.
Test Criteria	The extent of system meets specified requirements + system meets user expectations, i.e. acceptance criteria
Test Strategy	Black-box test strategy
Test Oracles	User requirements, operational procedures, quality manual
Test Tools and Environment	Comparator, documentation tool; test on operational platform
Tester	User and sometimes with developer

User acceptance testing allows organizations to identify and rectify any gaps or discrepancies, enhance system usability, and ensure that the continuous auditing system delivers reliable and actionable insights. It is derived from change management strategy as it ensures that the system effectively facilitates the desired changes within the organization while meeting user expectations and requirements, hence minimizing the possibilities of change reluctance in the shifting way of working from traditional to continuous auditing.

In-house Training

In-house training provides comprehensive training to end-users on the principles and how to operate the new continuous auditing system. In this phase, end-users are educated on various aspects of continuous auditing, including data collection, data analysis techniques, utilization of auditing software and technologies, and the interpretation of audit results. The training program aims to enhance the participants' knowledge and skills in applying continuous auditing practices effectively and to achieve smooth change management from traditional to continuous auditing workflow. HR department will be in charge to organize and deliver the training sessions.

This process is derived from the key success factor of change management strategy as it allows a smooth transition and adoption of the CA system within the organization by providing employees with the necessary knowledge and skills to embrace the changes brought about by the implementation of the new system.

5.2. Mapping Guideline Based on the Audit Maturity Level Evaluation

This sub-chapter focuses the shifts on the mapping of the implementation guideline based on the evaluation of audit maturity levels within organizations. Building upon the findings from

the previous chapter, which identified key success factors and assessed the audit maturity level, this section aims to provide a practical framework for organizations to effectively implement continuous auditing based on their audit maturity level.

As depicted in Figure 12, it is advisable for an organization with audit maturity level 1 to start their Continuous Auditing (CA) implementation journey by focusing on the Understanding Data and Business Processes stage. This recommendation is supported by several compelling reasons. Firstly, at maturity level 1, the organization is characterized by the limited awareness and understanding of its data assets and the underlying business processes. Therefore, acquiring a comprehensive understanding of the organization's data landscape and how it aligns with its core business operations becomes a crucial prerequisite. This foundational step allows the organization to establish a solid groundwork for implementing CA effectively. The successful execution of this process requires active collaboration among all stakeholders to attain a comprehensive and profound understanding, hence this process mapped to the key success factors of change management strategy.

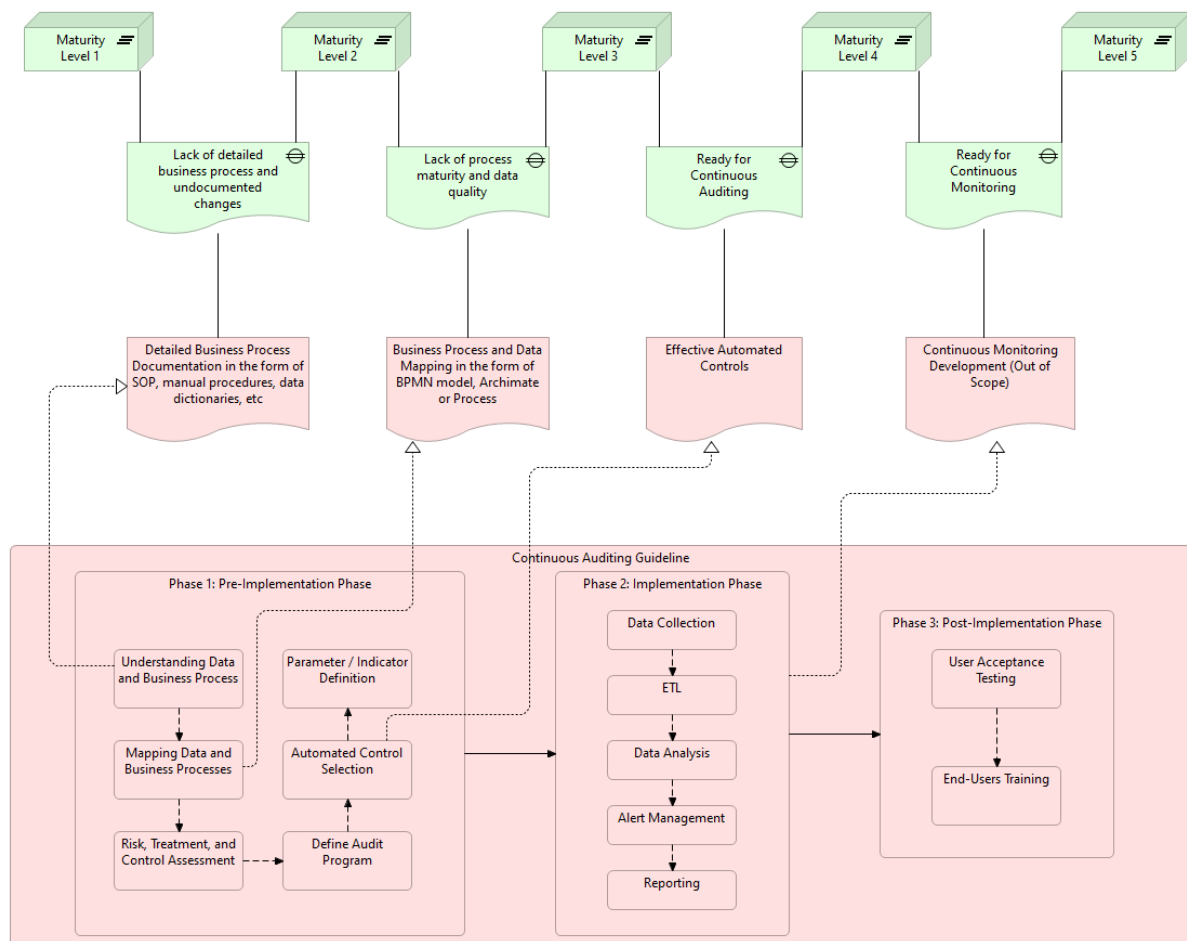


Figure 12. CA Implementation Guideline for All Maturity Levels

Considering the organization's maturity level 2, where the organizations lack process maturity and data quality initiating the pre-implementation process of continuous auditing with mapping the data and business processes is crucial. This step brings structure and discipline to internal control practices, allowing the organization to understand the operational aspects and identify

control points. By formalizing the mapping process, the organization establishes a standardized and compliant approach to internal control, ensuring consistency and transparency. Mapping the business processes aligns internal control efforts with business objectives, prioritizes resource allocation, and sets the foundation for a comprehensive internal control framework, preparing the organization for successful continuous auditing implementation.

At maturity level 3, it is strongly recommended that the organization initiates the process at Automated Control Selection. This recommendation is based on the organization's well-established internal controls, which demonstrate effectiveness in terms of their Test of Design (ToD) and Test of Effectiveness (ToE). With a robust internal control framework in place, including a well-documented risk register and controls, the organization will have a solid foundation to guide the audit process. Hence, they can start from automated control selection that can be effectively translated to continuous auditing system. In this phase, the organization is strongly suggested to perform analysis to determine which controls that can be automated in audit scope to be applied in the continuous auditing system.

For organizations at Maturity levels 4 and 5, which exhibit a high level of maturity in terms of risk and control management and possess the capability to identify and prioritize automated controls based on their associated risks, it is possible to bypass the pre-implementation phase and proceed directly to the development of continuous auditing. Given their advanced level of control sophistication, these organizations have already established effective internal control mechanisms and possess a deep understanding of their risk landscape. Consequently, they can confidently move forward with implementing continuous auditing without the need for extensive preparatory activities. This streamlined approach allows them to leverage their existing control framework and focus their efforts on refining and enhancing their continuous auditing practices to achieve greater operational efficiency and effectiveness.

The notable distinctions between levels 4 and 5 would be in the scope and capabilities of continuous auditing. While both levels demonstrate a high level of maturity in risk and control management, Maturity level 5 organizations exhibit a broader scope for continuous auditing compared to level 4. This expanded scope enables level 5 organizations to leverage predictive audit techniques in addition to descriptive audit methods and eventually to continuous monitoring.

5.3. Answers to Research Questions

This sub-section presents the discussion on the findings to answer sub research question 4: How can organizations effectively embed the key success factors and audit maturity level evaluation for continuous auditing in the implementation based on their specific needs?

Organizations can effectively embed the key success factors for continuous auditing by mapping them into a continuous auditing guideline consisting of three phases which are pre-implementation, implementation, and post implementation.

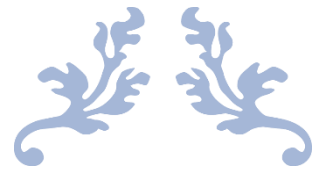
The mapping process involves aligning these success factors with each phase of the continuous auditing guideline. During the pre-implementation phase, organizations can focus in improving their audit maturity level until they reach the advised suggested level.

The implementation phase focuses on the development of a continuous auditing system, entails providing a systematic approach to creating the system. This involves outlining the step-by-step process for its development, as well as identifying the necessary technology and system modules required to bring it to fruition.

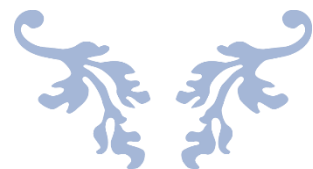
The post-implementation phase emphasizes continuous improvement and evaluation. Organizations use the mapped success factors to assess the outcomes of the implementation, measure the effectiveness of the continuous auditing practices, and identify areas for refinement. This iterative process enables organizations to adapt and optimize their continuous auditing approach based on their specific needs and changing circumstances.

5.4. Summary

The treatment design chapter focuses on providing a comprehensive continuous auditing (CA) guideline that effectively embeds the key success factors and incorporates audit maturity level evaluation based on organizations' specific needs. The CA guideline is structured into three distinct phases: pre-implementation, implementation, and post-implementation. During the pre-implementation phase, organizations are encouraged to focus on improving their audit maturity level to meet the suggested criteria. The implementation phase outlines a systematic approach to developing the continuous auditing system, encompassing the necessary technology and system modules. Finally, the post-implementation phase emphasizes continuous improvement and evaluation, using the mapped success factors to assess outcomes and identify areas for refinement.



Chapter VI



6. Validation of Key Success Factors and Audit Maturity Level Assessment in an Organization from Continuous Auditing

The chapter focuses on verifying the effectiveness and applicability of the proposed Continuous Auditing (CA) architecture and key success factors by presenting it to relevant stakeholders. The validation procedure encompasses the presentation of the Continuous Auditing (CA) architecture to relevant stakeholders and aligning it with the previously identified key success factors. This phase serves as the treatment validation stage within the design science engineering cycle by Wieringa, employing the research method of surveys in the form of expert interviews to assess the performance of the validation model in real-world scenarios. By conducting multiple interviews with experts from diverse backgrounds, the validation of this study gains broader applicability and undergoes comprehensive scrutiny.

6.1. Expert Validation

The purpose of the validation interviews was to gather feedback, opinions, and additional insights on the key success factors, audit maturity level assessment, and the proposed guideline. The interviews aimed to assess the clarity, relevance, feasibility, and practicality of the proposed framework and guidelines from the perspectives of both internal and external stakeholders.

This validation process includes the participation of four stakeholders, consisting of two from internal source and the remaining two are from external resource. The internal interviewees were individuals who were previously interviewed during the data gathering phase of the research, while the external interviewees were individuals who were not part of the organization being studied. They were selected based on their expertise and experience in the field of continuous auditing. The validation participants involved are outlined below:

1. Product Owner of Continuous Auditing Tools at an External Auditing Company.
2. Former Product Owner – Technical Side of Continuous Auditing System at an Indonesian company
3. Product User of Continuous Auditing System at an Indonesian company.
4. Former IT Auditor – Business Side of Continuous Auditing System at an Indonesian company.

The validation process was executed through a series of presentations, wherein the stakeholders were provided with an overview of the proposed key success factors and the guidelines for the pre-implementation, implementation, and post-implementation processes. These presentations were conducted individually for each stakeholder, according to their respective time frames. Subsequently, a set of structured interview questions was administered to the stakeholders to assess the viability of the proposed artifacts for implementation in a real-world scenario. The list of validation questions can be found in Table 11.

Table 10. List of Validation Interview Questions

Topic	Question	Objectives
Question 1: Understanding	Did you find any part of the key success factors, audit maturity level, or the guideline confusing?	<ul style="list-style-type: none"> Identify any confusing aspects of the key success factors, audit maturity level, or the guideline. Gather feedback on areas that may require further clarification. Understand the participants' comprehension of the presented information.
Question 2: Alignment	On a scale 1 – 5, how well do you think the proposed key success factors align with the goals and objectives of continuous auditing?	<ul style="list-style-type: none"> Evaluate the perceived alignment between the proposed key success factors and continuous auditing goals and objectives. Assess the participants' perspective on the effectiveness of the alignment.
Question 3: Additional Key Success Factors	Can you identify any additional key success factors that you believe should be included in the guideline?	<ul style="list-style-type: none"> Solicit suggestions for additional key success factors that should be included in the guideline.
Question 4: Adequacy of the Guideline	On a scale 1 – 5, do you think the proposed guideline adequately addresses the necessary steps and considerations for implementing continuous auditing? If not, what improvements or additions would you suggest?	<ul style="list-style-type: none"> Determine if the proposed guideline adequately addresses the necessary steps and considerations for implementing continuous auditing. Collect feedback on any perceived shortcomings or areas for improvement.
Question 5: Feasibility and Practicality	On a scale 1 – 5, how feasible and practical are the proposed guideline? Are there any specific challenges or obstacles you foresee in implementing the guideline?	<ul style="list-style-type: none"> Assess the participants' opinions on the feasibility and practicality of the proposed guideline. Identify any potential challenges or obstacles foreseen in implementing the guideline.
Question 6: Suggestions and Recommendations	Do you have any suggestions or recommendations for enhancing the clarity, comprehensiveness, or usability of the proposed guideline and key success factors?	<ul style="list-style-type: none"> Gather suggestions and recommendations for enhancing the clarity, comprehensiveness, and usability of the proposed guideline and key success factors. Encourage participants to provide specific ideas for improvement.

6.2. Validation Result and Analysis

The validation interviews provided valuable insights into the key success factors, audit maturity level assessment, and the proposed guidelines in organizations from the perspective of continuous auditing. The interviewees unanimously agreed that the proposed key success factors and audit maturity level assessment were clear and non-confusing. However, one of them requested for more detailed explanations of the key success factor of the talent. The confusion on talent key success factor was cleared once further explanation was presented to the interviewee.

In terms of alignment with the goals and objectives of continuous auditing, all interviewees rated the proposed key success factors highly, giving it a rating between 4 to 5 making an average score of 4.5 on a scale of 1-5. This indicates a strong agreement that the identified factors are relevant and crucial for successful implementation.

During the interviews, one interviewee suggested the inclusion of "tone of the top" as an additional key success factor in the guideline. This factor highlights the significance of leadership commitment and a strong ethical culture in driving successful continuous auditing practices. This suggestion had been adapted to this research and tone of the top management is included in the organizational condition requirements.

While the proposed guideline was generally rated as adequate (with a rating of 4 on a scale of 1-5), there were specific recommendations for improvement. Interviewees emphasized the need for a more extensive approach, including the incorporation of a scorecard to assess the audit maturity level, the addition of more detailed layers within each implementation phase, and the introduction of a review phase between alert management and reporting processes. This suggestion was not adapted due to the review phase is supposedly included in the alert management where the system user would need to manually check any exception found by the system before the system can go to the reporting phase.

Regarding feasibility and practicality, three interviewees rated the guideline as a 4, indicating a belief in its overall feasibility and practicality. However, one interviewee rated it as a 3.5 due to the missing aspect of tone of the top management which is the huge challenge according to the expert's experience.

To enhance the clarity, comprehensiveness, and usability of the proposed guideline, interviewees recommended incorporating concrete measures to assess the guideline's effectiveness once implemented. This would provide organizations with a clearer understanding of the impact and success of their continuous auditing practices. The summary of the validation interview can be seen in Table 12.

Table 11. Summary of Validation Interview

No	Questions	1	2	3	4
1	Did you find any part of the key success factors, audit maturity level, or the guideline confusing?	No	A bit more explanation on the key success factor of talent	No	A bit confusion to differentiate the wording key success

					factors and requirements
2	How well do you think the proposed key success factors align with the goals and objectives of continuous auditing?	5	4	5	4
3	Can you identify any additional key success factors that you believe should be included in the guideline?	N/A	Tone of the top management	N/A	Project management
4	Do you think the proposed guideline adequately addresses the necessary steps and considerations for implementing continuous auditing? If not, what improvements or additions would you suggest?	4	4	4	4
5	In your opinion, how feasible and practical are the proposed guideline? Are there any specific challenges or obstacles you foresee in implementing the guideline?	4	3.5	4	4
6	Do you have any suggestions or recommendations for enhancing the clarity, comprehensiveness, or usability of the proposed guideline and key success factors?	Designing a scorecard that evaluates the maturity level of organizations and to consider the organization's risk appetite to determine their level of commitment.	Suggested to incorporate the organization's risk appetite as a determinant of their commitment and to provide tangible examples of the proposed solution.	Suggested to incorporate the organization's risk appetite as a factor in determining their commitment and to develop a measurement tool to quantitatively assess the	Better visualization on the guideline as some of the processes are meant to be iterative.

				benefits of the proposed solution.	
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6.3. Answers to Research Questions

This sub-section presents the discussion on the findings to answer sub research question 5: To what extent does the identification of key success factors, audit maturity level evaluation, and the proposed guideline result in the effectiveness of continuous auditing implementation?

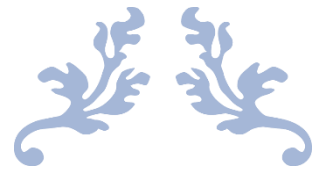
The key success factors identified through the research provide organizations with a comprehensive understanding of the critical elements necessary for successful continuous auditing implementation. These factors cover various dimensions, including organizational conditions, business process requirements, and technological requirements that will assist organization to create a strong foundation for implementing continuous auditing practices effectively.

Meanwhile, the assessment of the audit maturity level based on the CMMI framework allows organizations to evaluate their current auditing processes and identify areas for improvement. The maturity levels provide a structured framework for organizations to gauge the effectiveness and sophistication of their internal control systems so that they can reach the advised maturity level to effectively implement continuous auditing.

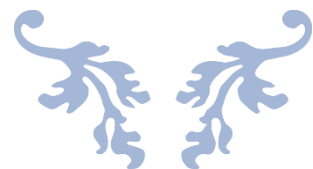
Lastly, the proposed guideline serves as a roadmap for organizations to follow when implementing continuous auditing. It provides step-by-step guidance, highlighting key considerations and necessary actions at each phase of the implementation process. The guideline covers various aspects, including data understanding, business process mapping, risk and control assessment, audit procedures, automated control selection, data collection, ETL processes, data analysis, alert management, and reporting. By following the guideline, organizations can ensure a systematic and well-structured implementation of continuous auditing practices.

6.4. Summary

The validation chapter examines the extent to which the identification of key success factors, audit maturity level evaluation, and the proposed guideline contribute to the effectiveness of continuous auditing implementation. The key success factors offer organizations a comprehensive understanding of crucial elements for successful implementation, covering organizational, business process, and technological aspects. The audit maturity level assessment based on the CMMI framework helps organizations evaluate their current auditing processes and readiness for continuous auditing adoption. The proposed guideline serves as a practical roadmap, providing step-by-step guidance for each implementation phase. Validation interviews with experts provided valuable insights, confirming the clarity and relevance of the key success factors and audit maturity level assessment. The proposed guideline was generally well-received, with minor recommendations for improvement. Interviewees highlighted the need for a more extensive approach, inclusion of "tone of the top" as a key success factor, and measures to assess guideline effectiveness post-implementation.



Chapter VI



7. Conclusion and Future Works

This chapter presents a concise summary of the findings and outline the future works of this research.

7.1. Conclusion

This research provides a comprehensive overview of the key insights gained from both theoretical literature and practical findings. The study presented the key success factors that leads to the successful implementation of continuous auditing in organizations, namely talent, organizational size, change management strategy, data standardization and business processes harmonization, good risk and control assessment, audit maturity level, ETL and big data capabilities, data collection and accessibility capabilities, and data analysis and IT capabilities. These factors are derived through a comprehensive review of relevant literature and conducting interviews with experts in the field. The selection of these factors takes into account the common challenges observed in practical scenarios and the findings reported in previous studies.

Furthermore, this study also highlights the importance of evaluating audit maturity levels using the CMMI framework to assess and enhance the effectiveness of auditing systems within organizations to the point that the organization can reach the advised level of audit maturity to implement continuous auditing.

Deriving the key success factors and audit system maturity level, this study proposed a guideline to assist the organizations to achieve a successful implementation of continuous auditing into their environment. The proposed guideline has been validated by experts with relevant expertise, further enhancing its credibility and applicability.

From the validation result, the external organization expressed their interest where they believe that the research can help them in explaining to their clients on how they can prepare to be ready to use the external organization's continuous auditing system so that the result of continuous auditing tools can be effective once it is implemented. On the other hand, there was different opinions among the internal auditors, where the former product owner believes that this research has brought values to ease the implementation of continuous auditing in organization, while the current product user thought that the findings of this study is no longer relevant to their organization as they are already in the continuous monitoring and predictive analysis in terms of their audit process.

7.2. Contribution

The identification of key success factors in this research adds depth and clarity to the understanding of successful continuous auditing implementation. These factors are not merely derived from theoretical speculation but are based on real-world experiences and challenges faced by professionals in the industry. The inclusion of both external and internal auditors in the interview process ensures a well-rounded perspective, making the identified success factors more robust and applicable across various organizational contexts.

From a practical standpoint, the insights and guidance provided by this research offer tangible benefits to organizations seeking to adopt continuous auditing for initial stage. The identified

key success factors act as a roadmap, guiding organizations to focus their efforts on critical areas that significantly impact the success of continuous auditing initiatives.

The proposed guideline, which is derived from the key success factors and takes into account the audit maturity level, offers a structured and systematic approach for organizations to effectively implement continuous auditing, avoiding common pitfalls and aligning with best practices. This study makes a significant academic contribution by bridging theoretical knowledge with practical insights in the field of continuous auditing.

7.3. Limitation

Despite the valuable insights provided in this research, there are certain limitations to acknowledge. The sample size of interviewees for the practical findings was relatively small, consisting of a few external auditors and internal auditors from a single organization. This may limit the generalizability of the findings to a broader range of organizations and industries. Another limitation would be the exclusion of a comparative analysis of organizations that have successfully implemented continuous auditing versus those that have not. Such an analysis could provide additional insights into the impact of key success factors and audit maturity evaluation on continuous auditing effectiveness. In addition, the research faced time limitations, which affected the scope of data collection and the ability to conduct in-depth case studies or observe continuous auditing practices over extended periods.

Despite these limitations, the research provides valuable insights and a foundation for further exploration and advancements in the field of continuous auditing. Organizations should consider these limitations when applying the key success factors and proposed guideline to their specific contexts. Future studies can address these limitations and expand on the research to provide a more comprehensive understanding of continuous auditing practices.

7.4. Future Work

This sub-chapter dives into future research and development in the field of continuous auditing. This study discusses several areas that warrant further exploration and refinement. Firstly, it emphasizes the need for continuous improvement and expansion of the proposed guideline for continuous auditing implementation. Incorporating feedback from practitioners and conducting empirical studies will contribute to its robustness and applicability in diverse organizational contexts.

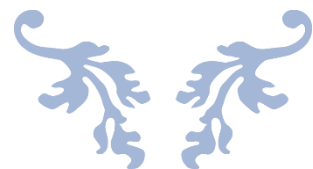
In addition, it brought up the potential impact of emerging technologies on continuous auditing practices. The integration of artificial intelligence, machine learning, and advanced analytics holds immense potential in revolutionizing data analysis and decision-making processes as it was mentioned by the current product user of continuous auditing. Future researcher can investigate how these technologies can be harnessed to optimize continuous auditing procedures and enable organizations to extract deeper insights from vast amounts of data to the point that it can help organizations to effectively reach continuous monitoring and predictive analysis.

Furthermore, there is a potential for future research to delve into quantitative studies that measure the efficacy of the proposed guideline. The purpose is for the organization can quantify the outcome and impacts of continuous auditing implementation in their environment, which in turn, can facilitate greater management buy-in and commitment to the adoption of

continuous auditing practices. Assessing the effectiveness of the guideline will also contribute to the overall understanding of its applicability in different organizational contexts. Such research will enable organizations to gauge the return on investment and justify the allocation of resources towards implementing continuous auditing.



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Appendix

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Appendix

Strategic Objective (Function)	Process	What Could Go Wrong (WCGW) Process Level/ Risk	Root Cause	Impact	Likelihood	Risk Score	Current Key Control	Control PIC	
Annual Objective 1	Receive & Verify New Bank Account Request	Missing documents	Employee Negligence	4	2	8	Training Employee Four-eye principles	HR Account Manager	
			Document Corrupted by the System	4	1	4	Designated & secured file storage Updated antivirus Scheduled backups	Account Manager IT Manager IT Manager	
	Document Verification	Incorrect documents inputted	Employee Negligence	4	2	8	System validation	IT Manager	
			System Error	4	1	4	System validation	IT Manager	
	KYC Checklist	Incorrect KYC decision	Insufficient Checklist Variables	5	2	10	Annual verification to update KYC variable		
	Internal Blacklist Check	Incorrect Blacklist decision	Cyber incidents		5	1	5	Updated antivirus Annual penetration test	IT Manager IT Audit Manager
							Cyber awareness training	HR	

Figure 13. Risk and Control Assessment

What Could Go Wrong (WCGW) Process Level/ Risk	Current Key Control	Audit Procedures	Control Type	Audit Approach	Level of Assurance	Nature of Audit Procedures		Timing	Extent	
						Purpose	Type			
Missing documents	Training Employee	AP1	Check SOP for existing training emp	Manual	Substantive Approach	Moderate	Ensure employees are trained	Inspection	Prior to the audit engagement	Training employee
		AP2	Check training record of all employees	Automated	Substantive Approach	Moderate	Verify training completion	Inspection	Prior to the audit engagement	All employee training records
	Four-eye principles	AP3	Check user authorization for document review	Automated	Reliance Approach	High	Verify compliance with four-eye principles	Tests of Controls	Throughout the audit engagement	Sample of document review authorizations
		AP4	Check SOP for four-eye principle	Manual	Substantive Approach	Moderate	Ensure the existence of a four-eye principle	Inspection	Prior to the audit engagement	Four-eye principle SOP document
	Designated & secured file storage	AP5	Manual observation for the file storage	Manual	Reliance Approach	Moderate	Ensure proper file storage and security	Observation	Throughout the audit engagement	Sample of file storage areas
	Updated antivirus	AP6	Check version history of antivirus	Automated	Reliance Approach	Moderate	Verify antivirus software updates	Inspection	Throughout the audit engagement	Antivirus software version history
	Scheduled backups	AP7	Check access authorization for scheduling backups	Automated	Reliance Approach	Moderate	Verify access controls for backups	Inspection	Throughout the audit engagement	Access authorization for backup scheduling
		AP8	Periodic check on the schedules	Manual	Reliance Approach	Moderate	Ensure scheduled backups are performed	Inspection	Throughout the audit engagement	Sample of backup schedules
		AP9	Check backup history	Automated	Reliance Approach	Moderate	Verify backup history and completeness	Inspection	Throughout the audit engagement	Backup history records
Incorrect documents inputte	System validation	AP10	Manual Check by IT Audit	Manual	Substantive Approach	Moderate	Identify and rectify incorrect inputs	Inspection, Re-performance	Throughout the audit engagement	Sample of input data and system validation tests
		AP11	Manual Check by IT Audit	Manual	Substantive Approach	Moderate	Validate the accuracy and integrity of the system	Inspection, Re-performance	Throughout the audit engagement	Sample of system validation tests
Incorrect KYC decision	Annual verification to update KYC variable	AP12	Manual Check by IT Audit	Manual	Substantive Approach	Moderate	Identify and correct incorrect KYC decisions	Inspection	Throughout the audit engagement	Sample of KYC decisions
Incorrect Blacklist decision	Updated antivirus	AP13	Check version history of antivirus	Automated	Substantive Approach	Moderate	Verify effectiveness of blacklist updates	Inspection	Throughout the audit engagement	Antivirus software version history
	Annual penetration test	AP14	Manual Check by IT Audit	Manual	Substantive Approach	Moderate	Identify and correct incorrect Blacklist decisions	Inspection, Re-performance	Throughout the audit engagement	Sample of penetration test results
	Cyber awareness training	AP15	Check SOP for existing training employee	Manual	Substantive Approach	Moderate	Ensure employees receive cyber awareness training	Inspection	Prior to the audit engagement	Cyber awareness training SOP document
		AP16	Check training record of all employees	Automated	Substantive Approach	Moderate	Verify training completion	Inspection	Prior to the audit engagement	All employee training records

Figure 14. Audit Procedures Sample

Table 12. Qualitative Analysis Based on Target

No	Reference Target	Synthesis	Reference	Remarks
1	D	Continuous auditing is a systematic approach that empowers independent auditors to provide written assurance regarding a specific subject matter. This methodology involves the issuance of a series of auditors' reports that are generated either virtually at the same time as, or shortly after, the events that form the basis of the subject matter have transpired.	P3, P20	Definition was obtained from previous research.
		Continuous auditing refers to a methodology that enables independent auditors to deliver written assurance concerning a particular subject matter. This approach involves the issuance of a series of auditors' reports that are generated either simultaneously with or shortly after the events that form the basis of the subject matter have taken place.	P6	Definition was obtained from previous research.
		Continuous auditing (CA) is a method that primarily emphasize on the acquisition of audit evidence and indicators from various systems, processes, transactions, and controls. These elements are collected in a frequent or continuous manner by assurance functions, which are further supported by analytical technology tools.	P10	Definition was obtained from previous research.
		Continuous auditing is a procedure utilized by auditors to oversee controls and risks, gather evidence utilizing technology, and deliver prompt reporting on anomalies and recommendations.	P21	Definition was obtained from previous research.
		Continuous auditing is a method that allows independent auditors to provide written assurance regarding a specific matter, for which the management of an entity holds responsibility. This is achieved through the issuance of a sequence of auditors' reports that are generated virtually simultaneously with, or shortly after, the events forming the basis of the subject matter.	P23	Definition was obtained from previous research.
2	C	The country's market for ERP as facilitating tools for CA has not matured yet.	P3	
		Significant resources to invest, the complexity of designing and maintaining IT systems, analyzing heterogeneous data, the necessary competence mix.	P11	
		Technical implementation, external auditors' independence, adjustment of audit procedures, auditors' education, documentation of CA projects, and data security and privacy.	P19	
		Risk of audit-data manipulation, security challenges, and automation & cloud service individualism.	P20	

		Leveraging information technology and maintaining the required skillsets within companies.	P21	
3	KS	The first domain that is formulated is Efficiency. We decided to use efficiency as overarching term for the benefits. In the interviews, Frequency was mentioned as perhaps the most important dimension. The reduction of manual activities through the automation of controls will decrease the likelihood of human errors. This decided us to distinguish the dimension Errors. Another dimension is Compliance	P10	
		Success factors are also of paramount importance for practitioners, as they describe the key organizational issues that must be solved to efficiently implement the model. They show that effective continuous audits are centered on an integrative approach and elements of change management (Al-Mashari, 2003). With the help of the AST case, we have revealed that these elements include a strategic vision and risk mapping as well as a no-corruption corporate culture. They enable the model to be implemented by a company and prepare employees for compliant behavior, preventing corruption at its core.	P11	
		Our synthesis of the 60 articles shows that the successful use of CA system can be measured through four elements which are participant quality, system quality, information quality and products and services quality.	P18	
		There are 18 key performance indicator samples, with suggested data sources for continuous monitoring and auditing in Municipalities, such as variation, number of ended treatments, value of newly started treatments, and many more.	P23	Referring to continuous control monitoring.
4	TS	Technologies: - Leveraging artificial intelligence in the auditing process for procedures automation, evidence scope enlargement, and overall effectiveness and efficiency improvement. - The enabling technologies in continuous auditing are XBRL (eXtensible Business Reporting Language), artificial neural network, and intelligent system to allow data access for different business units without compatibility problems and to function the sensors to observe the audit environment. - In the fourth stage, data mining is implemented to detect the “exceptional exceptions.” A great variety of data mining tools are available. The process mining algorithm is used to search for data patterns. The technical data are translated into behavioral data to answer such questions as “Is the last employee who modified the transaction also the approver?”.	P1, P4, P6, P9, P11, P12, P14, P15, P21, P22, P23, P24	The papers are mostly discussed about the technology enabling the continuous auditing, instead of the requirements or system maturity level.

		<ul style="list-style-type: none"> - Big data paradigm with the combination of multiple technique can be implemented in continuous auditing cockpit and as a computational core for the analytics. - Key-based authentication and encryption is implemented to bridge the communication and transmission between multiple systems (hosts). - This study utilizes the online model learning protocol, an essential feature of a CA system. In this protocol, each newly updated analytical model is used solely to predict one new segment of data. - Full CA/CM techniques rely heavily on fully developed ERP systems and business intelligence platforms. - Many CA approaches are built up on embedded audit modules (EAM), which can be declared as the major construct of CA in its early days. Further essential technical constructs are general audit software (GAS), and systems control and review facility. Additionally, tools for the monitoring of accounting-relevant processes are discussed in literature (i.e., monitoring control layer, MCL). - Computer Assisted Audit Tools and Techniques (CAATTs) are any technological tools and techniques that help internal auditors perform the auditing process and can be used to enable continuous auditing. Data modelling and benchmark development, Data analytics also play essential roles in automation of audit procedures. - Analytics Software, CAFI is a continuous auditing module, that is built on top of the IDEA data analytics software, developed by CaseWare. CAFI makes it possible to build a dashboard, showing data values and outcomes of various tests of controls (authorizations, segregation of duties, reconciliation). 		
		<p>Roles & Impacts:</p> <p>Information technology should not be considered as black box, or a “monolith” and it should follow that the sophistication and complexity of the applications of continuous auditing technology would depend on what functionality is available in the specific solution.</p>	P5	
	BP	<p>Steps:</p> <ul style="list-style-type: none"> - As mentioned above, the big data audit procedure based on the financial shared service model needs to complete the following three steps: Data Analysis, Establishment of Intermediate Tables and Formation of Audit doubts. 	P7	

5		Mentioned the importance of defining business processes in initialization of continuous auditing process.	P13, P14, P16, P17, P23	
		Selecting the scenarios of continuous monitoring was performed by generating a risk pool and categorized the pool. For this process, business process is required during the ERP implementation.	P22	
		Business processes are essential in determining the control to be implemented in continuous auditing.	P23	
6	OC	Categorized the organization characteristic or conditions into three categories of complex adaptive, Singerian inquiring system, and complex adaptive inquiring organization.	P2	
		Defined the organization condition based on the geographical area to determine whether the institutions in the specific country (generalization) are ready for continuous auditing.	P1, P3, P6	
		Highlighted the organization condition in terms of size (small or medium business) to determine the importance and impacts of continuous auditing in such business.	P5, P17	
		Definition: A condition represents a set of restrictions that prevent specific CSC goals from being achieved unless they are otherwise fulfilled. Aspects of a condition deal with setting essential specifications for ensuring that all specified goals are met; risks mitigated; and the continuous monitoring or auditing of migrated entities is supported by the CSP.	P8	
		Motivation: Is a CA/CM implementation only possible or feasible for larger firms that have established ERP systems and are publicly regulated?	P16	
7	RF	Objective: This framework can be seen as a first endeavour that offers executive management a guidance in assessing the value of CA/CM.	P10	
		Attributes & Requirements: - The value in the CA/CM evaluation framework is broken down into three distinguished domains, respectively Efficiency, Assurance and Quality. - This framework is supported by a detailed review of the development of continuous audits and provides the most comprehensive understanding of innovation and advances in auditing using technology and automation.	P10, P11, P13, P14 P17, P20, P21	

	<ul style="list-style-type: none"> - Our proposed architecture for a continuous process audit as- a-service (AaaS) system is composed of several subsystems, describable in terms of ontologies. These are constituted by domain knowledge of services and processes as an efficient storage, audit rule ontology and rules engine for storage and enforcement of audit rules, and implementation of recommender engine for generating adaptable audit rule and recommending audit report. - Especially, recent academic research related to conceptual models on CA can be categorized into three elements. First, to enhance the effectiveness of the CA system, prior studies introduce a novel approach which develops the existing CA architecture by prioritizing alarms and adding layers of (1) data aggregation and transaction verification to identify unusual transactions; (2) transaction verification to detect internal control violations; and (3) analytical monitoring to capture significant statistical deviations from the typical trends of an organization's business behaviour. - List of personalized questions were formulated to develop the framework such as the accuracy of the information collected, test for duplicate transaction, and integrated systems in the organization. - A communication model is required. A monitoring and control layer can also be implemented as an independent auditing system. This system forms an overlay on top of a set of existing systems and utilizes a middleware layer to provide integration between loosely coupled applications such as auditees' service applications and legacy systems. - Exploring internal auditors' attributes required and the auditing environment using different theories requires a conceptual model. In this study, a model has been developed using UTAUT model and KSA competency model to explore individual attributes (attitude towards use of IT and competencies) while Structuration and Classical Management theories explain the auditing environment and its impact on using IT for continuous auditing. 		
	<p>Reference & Design Flow:</p> <ul style="list-style-type: none"> - The framework created with Big Data analysis with 9 main steps to realize the continuous auditing. - The Continuous Monitoring System prototype is based on the Monitoring Control Layers architecture. 	<p>P9, P16, P24</p>	

		- There are three main steps in designing continuous control monitoring, namely: (1) Significant risk factors identification and internal control check collection; (2) Data preparation, and (3) Continuous control modelling.		
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Table 13. List of Interview Questionnaires

Personal Questions
What is your role in the organizations?
What is your experience with CA?
Intoduction to CA
How would you define continuous auditing?
What makes it different from conventional auditing?
What would be the most common controls for CA implementation?
What would be the most common motivation for companies in implementing CA?
Is there any demand for CA implementation in FI?
Gap Validation
What are the biggest challenges KPMG faces in implementing Continuous Auditing for clients?
Is there any standard or framework that serve as reference for CA implementation?
How significant does the existing framework bring benefit to the implementation?
How effective is the auditing processes once CA is implemented?
What are the differences between theoretical best practices for Continuous Auditing and the actual implementation in your organization?
How do you address the gaps between theoretical findings and the actual implementation of Continuous Auditing in your organization?
What are the benefits and drawbacks of Continuous Auditing in an organization, and how do they compare with traditional auditing methods?
Framework Development
How is the implementation process of continuous auditing?

What benefits that are attractive for companies to start implementing CA?
How do you determine that an organization is ready to adopt CA?
Can you describe your experience with developing frameworks for CA?
What methodologies or best practices have you found to be effective?
How do you determine the scope and objectives of a CA framework?
What tools or techniques do you use for data analysis and monitoring in Continuous Auditing, and how effective are they?
How do you ensure data accuracy and completeness in CA program?
What tools or techniques do you use for C&A?
How do you manage and analyze large volumes of data in CA?
What tools or techniques do you use for BD?
Can you walk me through the process of selecting the key risk indicators for CA program?
How do you ensure that they are relevant and effective?
How do you identify and prioritize risks and controls in the development of a CA framework?
what tools or techniques do you use for risk assessment?
How do you measure the effectiveness of Continuous Auditing Framework, and what metrics do you use?
How do you ensure that the continuous auditing framework is scalable and can be applied across different business units or processes within the organizations and across different organizations' size?
How do you ensure that the continuous auditing framework is sustainable and can be maintained over the time, and what steps do you take to ensure its ongoing effectiveness?