# Maturity Level Continuum Paradigm of Internal Audit Function

## Based on pilots performed during the period 2008 - 2022

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*Abstract*— **Continuous (control) monitoring, continuous auditing, continuous assurance, continuous reporting and the Continuum Paradigm are topics in which research has been performed for more than 30 years. The possibilities and challenges of these elements have been researched frequently. However, there are limited studies focused on the holistic view. Several pilots, financial as well as non-financial data, in relationship with the Audit Maturity Model have been performed. Based on the existing studies, we defined the following research question: What is the actual status regarding the Continuum Paradigm? Based on a review of pilots and plotting the results of the pilots on the Audit Maturity Model by a focus group, further insight is provided regarding the actual status. In this paper, we re-address and - present our earlier work, yet we extended the previous research with additional research by adding one pilot and extended the participants to plot the pilots with 13 members of the following three professions (1) internal audit, (2) external audit and (3) business. In addition, we provide a more detailed description of the related literature, findings, and results. The overall conclusion is that the average maturity level for Continuous Monitoring and Continuous Assurance reaches nearly stage 3: 'Maturing and no research has been performed based on a holistic and fully integrated continuous process'.**

*Keywords – Audit Maturity Model; Continuous (Control) Monitoring; Continuous Auditing; Continuous Assurance; Continuous Reporting; Continuum Paradigm; Financial and Non-financial Data; Sustainability Reporting.*

## I. INTRODUCTION

Scientific papers in the context of the Continuum Paradigm in nature have often been descriptive in recent years. Common concepts within this research area are Continuous Auditing (CA), Continuous Assurance (CAss), Continuous Monitoring (CM), Continuous Control Monitoring (CCM) and Continuous Reporting (CRe). This whole is now referred to as the Continuum Paradigm [1] [2].

The definition of the Continuum Paradigm is a holistic and pragmatical CA maturity model, which facilitates the assessment of CA capabilities [1] [2].

Only a few studies have been conducted in practice within Continuum Paradigm, combined with results of pilots. What is the actual status regarding the Continuum Paradigm? Based on earlier research, the aim is to provide insight in the actual status.

Maturity models [1] [2] [3] can be helpful to provide insight in the actual status. Maturity models enable organizations to assess their current situation and provide handholds for improving and future research. An example of the maturity model is the Audit Maturity Model (AMM) proposed by, Vasarhelyi, Alles, Kuenkaikaew and Littley [3]. For the purpose of our research, we assessed and plotted the outcomes of a number of selected pilots on a maturity model. Two pilots of 2008 have been selected, research of 2015 has been used as reference and one description of an Internal Audit Function of 2022 has been prepared and added to perform research to identify trends within the Continuum Paradigm.

The current study extends previous research by adding the results from three pilots instead two. The background of the participants has been extended with experts in the area of internal audit, external audit and business. The number of participants has been extended from three to fifteen.

The remainder of this paper is structured as follows. Section two summarizes the results of the literature review. The research method is described in section three. In section four, the data collection is described. The results are described in section five. Section six describes areas for future research. Finally, the paper concludes in section seven with the conclusion.

## II. LITERATURE REVIEW

The need for ongoing, timely assurance of data and information utilizing CA, CAss, CM, CCM and CRe is becoming more apparent.

In the last decades, Vasarhelyi, Kuenkaikaew, Alles and Willems [3] performed research in the area of CA, CAss, CM, CCM and CRe. However, this research was mainly related to financial data. Nowadays management needs additional data to provide assurance of non-financial data, driven by regulation, e.g., regarding climate change and the appetite of stakeholders to be timely informed.

Due to these developments the interests for CA, CAss, CM, CCM and CRe grow. When assessing the reliability of data produced by the system, the auditor will review confidentiality, integrity, and availability and how the data is ensured by the system of internal controls. IT and the AMM can be used to allocate the current status of CA, CAss, CM, CCM and CRe. The allocation provides insight in the actual level of auditing. This is relevant information to guide research and further developments of these elements.

There are several ideas of what continuous concepts and systems are, and how they work. Each of the concepts has their own definition. CM is "the process and technology used to detect compliance and risk issues associated with an organization's financial and operational environment" [5]. The financial and operational environment consists of people, processes, and systems, working together to support efficient and effective operations. Controls are put in place to address risks within these components. Through CM of the operations and controls, weak or poorly designed or implemented controls can be corrected or replaced – thus enhancing the organization's operational risk profile. Investors, governments, the public and other stakeholders continue to increase their demands for additional effective corporate governance and business transparency.

The most widely accepted definition for CA is the one released in 1999 by CICA/AICPA and reads as follows: "a methodology for issuing audit reports simultaneously with, or a short period of time after, the occurrence of the relevant events" [6]. The definition for CAss released by Vasarhelyi is therefore "an aggregate of objectively provided assurance services, derived from continuous online management information structures—the objective of which is to improve the accuracy of corporate information processes. These same services may also provide different forms of attestation including point-in-time, evergreen, and continuous" [7]. CAss and CRe are closely linked. There is no CAss without monitoring and intense measuring of the data and data sources.

The AMM classifies the audit evolution into four stages, which are traditional audit, emerging, maturing, and continuous audit. Per stage seven domains have been considered: objective, approach, IT / data access, audit automation, audit and management sharing, management of audit functions, and analytical methods [8].

The first domain is related to a "level of internal audit organization providing financial reports and monitoring internal controls including the task that is undertaken by CA systems". The second domain is related to a "method of audit review, frequency and technique including the extent to which audit outputs shift from being periodic to being undertaken continuously". The third "domain IT / data access" is related to the level and frequency of access to the

information system, firm's data systems and general data. The fourth domain "audit automation" is related to the automated level of auditing, usage of technology to assist the audit review cycle. The fifth domain "audit and management" sharing is related to an internal audit department shares systems and resources with management and between the different functions, e.g., finance, legal, tax, compliance, sourcing, production, research and development, sales, distribution and supply chain. There is access to the data and the system is utilized together. The sixth domain "management and audit function" is related to the degree of cooperation between financial audit and IT audit, collaboration with other compliance departments. The seventh domain "analytic methods" is related to the level of technical sophistication of analytical procedure that an internal auditor performs, techniques, and details. The general purpose of maturity model is to provide guidance for a sustainable implementation and growth for organizations [9]. See Table XI: Audit Maturity Model. To improve the readiness of the article, all relevant abbreviations are presented in Table I below.

TABLE I. OVERVIEW RELEVANT ABBREVIATIONS

| Abbreviation | Description |
|---|---|
| AMM | Audit Maturity Model |
| CA | Continuous Auditing |
| CAss | Continuous Assurance |
| CM | Continuous Monitoring |
| CCM | Continuous Control Monitoring |
| CRe | Continuous Reporting |

## III. RESEARCH METHOD

The goal of this study is to create an overview of the actual status of the separate elements of the Continuum Paradigm. Maturity models are a well-known instrument to support the improvement of functional domains.

A focus group is a group interview involving a small number of participants who have other common experiences. The focus group should be based on the group of individuals that best represents the phenomenon studied. A focus group existing three professions of (1) internal auditors, with a broad experience in internal auditing, (2) external auditors, with a broad experience in external auditing and (3) business and senior managers with background in auditing and with a broad experience on business rules has been established. For each profession 5 members have been selected and were invited to participate in this research.

The focus group exists of 15 members. Response has been received by 13 members. Only one member was a female. The average years of working experience of the focus group was 24 years. The average years of experience in auditing was 16.9, of which 9.17 in external audit and 7.75 in internal audit.

Before a focus group is conducted, a number of topics need to be addressed: (1) the purpose of the exercise, (2) the selection of the participants, (3) the number of participants, (4) the protocol of the focus group, (5) the AMM model, (6)

the protocol for plotting the pilots on the AMM model and (7) useful pilots for research. These have been addressed by a core team of three researchers.

Based on the research performed in the past, there are different AMM models available. First, we needed to select which AMM model could be used as reference model for this study. The AMM as described by Mantelaers & Zoet [2] and the AMM as described by Vasarhelyi [3] have been selected as starting point. Both AMM's have been compared. The AMM of Vasarhelyi has been used intensively in research articles since 1990. This AMM has also been used as reference for one other similar study (Metcash's). For that reason, it has been decided to use the AMM of Vasarhelyi.

The next step was to define what pilots could be used to perform this study. Research articles during the period 1990 until 2021 have been selected by the core research team using the following separate and combinations of the key words: audit, auditing, assurance, combined, control, continuous, data, external, financial, integrated, internal, maturity, model, monitoring, non-financial, pilot(s) and studies. The results have been reviewed by the core research team resulting in seven useful articles. Based on the review of the articles there are limited articles published containing sufficient detailed data and information to make it possible to rank and plot the results in the AMM of Vasarhelyi. The content of the selected articles, the level of detail of the data, level of detail of description of the data collection have been investigated. Based on the defined seven sections of the AMM and the data in the articles, we searched for relationships and references. In case that there were sufficient relationships and reference these articles were selected to rank and plot the results in the AMM.

The core team of three researchers requested a Head of Internal Audit of a South African listed firm to describe the current status of the Internal Audit Function. Adding the current situation of a listed firm provides the option to identify trends regarding the Continuum Paradigm over the period of nearly 15 years.

In the article of Hardy and Laslett, the results of the study have been plotted in the AMM [9]. The aim of this paper is to report on the implementation of CA and CM at Metcash Limited, an Australian wholesale distribution and marketing company (hereafter, Metcash). The results for this organization are so far notable: over 100 fully automated tests performed daily, a fully integrated exception management system, advancement from data to predictive analytics, and the use of visualization technologies for enhanced reporting. The results of this study have been used as reference to compare the results.

Every participant followed the same protocol, each starting with an introduction and explanation of the purpose and procedure of the meeting. After the introduction, ideas were generated, shared, discussed, and refined by the participants. Furthermore, the participants were invited to submit secondary data regarding CA, CAss, CM, CCM and CRe in the AMM.

Based on the pre-work, two pilots and the actual description of the Internal Audit Function of a South African listed firm have been identified by the researchers useful for plotting the results on the AMM. Each participant plotted the pilots individually. The results have been collected and the average results have been calculated for all three pilots. The average results of the three pilots have been compared with the reference pilot of Metcash's. The results have been shared and discussed with the focus group and the core team of three researchers. During this meeting conclusions have been defined and agreed.

The applicable corporate governance code for South African Listed Firms is King IV [12]. In this code the Combined assurance model has been introduced. A combined assurance model incorporates and optimizes all assurance services and functions so that, taken as a whole, these enable an effective control environment, support the integrity of information used for internal decision-making by management, the governing body and its committees, and support the integrity of the organization's external reports. This model has no impact on the internal control system of an organization, as this should be risk based. For that reason, there is no major difference between an internal audit function for a South African listed firm versus a non-South African listed firm.

## IV. DATA COLLECTION

Per pilot further information will be provided as well as the reason why the data has (not) been used for further research.

### A. Reference Pilot: Metcash's

The goal of the Metcash pilot (the subject) was to provide key lessons relating to the adoption and implementation of CA and CM because of its advanced maturity. A maturity assessment of Metcash's CA/CM activities was conducted [3]. The results are mapped onto the four stages and seven dimensions.

This research has been performed during 2015 and the articles provided detailed information how to plot the results of a pilot or study [9]. For that reason, the outcome of this study has been used as reference to provide insight in the gap and deviations with other pilots or studies.

Reference research three Pilots: SAPSECURE, CAMAP and BAGHEERA-S™.

The goal of this study of the three studies (1) SAPSECURE. (2) CAMAP and (2) Bagheera-S™ is to collect evidence from actual implementations for the need of CA and CM [9]. SAPSECURE was developed to permit auditors to review SAP security settings on a regular basis. It may also be used to provide answers to questions such as, ''Who can create a vendor, enter an invoice, and pay it?'' SAPSECURE was implemented and tested in a large public-sector organization. The design of CAMAP is based on surveillance of financial transaction data with the intention of profiling and identifying users that violate Segregation of Duties. This CA/CM solution provides an automated, independent mechanism for monitoring key business processes within an organization. Bagheera-S™ has the capability to report on three key business processes: (1) Payroll / Human Resources, (2) Procurement and (3) Finance. The outcome of the three studies SAPSECURE,

CAMAP and BAHEERA-S™ could not be used to plot the results on the AMM as data was missing with regard to approach, IT/Data Access, audit and management sharing and management of the audit function.

### B. *Pilot: VODAFONE*

The American Institute of Certified Public Accountants (AICAP) published a booklet Audit Analytics and Continuous Audit. In this booklet reference is made to the Vodafone Iceland pilot: Implementing Continuous Monitoring [6]. The scope of the project was to implement an IT application called, 'exMon', for revenue assurance as revenue leakage is a known issue in the telecom industry, to decrease the time required to process the financial closing month-end, fraud detection and to enhance the quality of the Customer Relationship Management. The data of the Vodafone Iceland project was limited and for that reason this could not be used to prepare an AMM rating.

### C. *Pilot: Siemens*

One of the main advantages of this pilot was to test how CA would move from concept to implementation. Vasarhelyi predicted both that ERP-enabled firms are the environments most suited to first deploy CA, and that the course of the implementation would begin with automation of existing audit procedures and then, once the feasibility and value added has been demonstrated, move on to re-engineering the audit to make it extra CA ready [4].

At Siemens several hundred procedures regarding Audit Action Sheets are created (these sheets are detailed descriptions of internal audit working papers), which describe in considerable detail what the internal auditor is supposed to test for in each SAP system environment. After examination of 25-30 Audit Action Sheets, twelve were chosen as representative of the challenges on automating and reengineering. The Audit Action Sheets are related to inadequate protection for SAP access. Testing one of the major general IT controls, logical access, which is non-financial data. In Visual Basic a prototype has been developed. The Siemens experience indicates that in environments characterized by highly automated business processes, CA can be defined as a process that continually tests controls based upon criteria prescribed by the internal auditor and identifies exceptions for the internal auditor to perform additional procedures. During this project the CM of internal control settings into the CA concepted model have been achieved. This included the treatment of transactional level data (non-financial).

The adoption of CM of automated business process control settings at the mode of CCM was a novel contribution to the project. This approach could not be utilized systematically in the past because of the extent of automation of business process controls was extremely limited. The current high level of business process automation and specific Robotic Process Automation (RPA) in leading companies such as Siemens makes this feasible and attractive [10]. The ongoing broad advances of business solutions across many industries will support the process as well as the implementation of the Continuum Paradigm.

### D. *Pilot: HSP*

The HSP project is based on modeling processes required data at a highly disaggregate level, far below the level of account balances that are used in the standard audit analytical procedures. Due to fact that there was access to the full richness of the dataset, it was feasible to create the process-based audit models using as benchmarks. Continuity Equations (CE) has been defined by Rogers as stable probabilistic models of highly disaggregated business processes [11]. The CE defined is related to the following strictly enforced business rule of the procurement process: no deliveries are to be accepted without a cross reference to a purchase order. The existence of a deterministic relationship between the counts of purchase orders sent and of the shipments received can be tested. The HSP experience indicates that for CE systems of this level of complexity require powerful statistical techniques, which allow for dynamic set of CEs with multiple time lags and feedback loops. The experience also made clear that CEs to become an essential component in the future CA systems, they will have to be sufficiently easy to implement. This means that generic CE models developed in the laboratory must be generally applicable to different firms and processes.

### E. *Pilot: South African Listed Firm*

The Head of Internal Audit of a South African Listed Firm and three Internal Auditors have been interviewed. Based on these interviews a description has been made of the actual status of the Internal Audit Function by the core team.

The description and data collected has been reviewed by an independent researcher to verify the correctness and completeness of the description.

New IT developments such as RPA, Data Analytics, Process Mining have been taken into account. This provides the option to extend the research and align with the actual status of the Internal Audit Function.

Based on the results provided by the independent researcher the core team of three researchers decided to add this pilot and requested the participants to plot in addition the South African Listed Firm.

The South Africa Listed Firm was founded in 1936. The firm operates globally. There are an Internal Audit Function and an Audit and Risk Committee established.

The combined assurance approach as described in the KING IV corporate governance code [12] has been adopted.

At the Internal Audit department 17 FTEs are employed. The main part of the auditors is based in South Africa. Several auditors are based in Europe and in the United States. The average years of experience of the internal auditor is more than 15 years. There are several specialists, two IT auditors, one sustainability auditor and one forensic auditor member of the Internal Audit team. The other are operational auditors with a background in at least two areas, e.g., finance and IT, production and technical, technics and supply chain, compliance and legal, etc.

IT Controls have been defined for the areas: Business Development, Entity-level Controls, Legal Compliance, Risk Management, Expenditure, Financial Reporting, Fixed

Assets, HR and Payroll, Inventory, Revenue, IT Cobit, IT SAP Basis (around 60 in total), IT ICS Security, IT Cloud Computing, IT Network, IT Local Applications, IT RPA, Treasury, Taxation, Internal Audit Professional Standards, Sustainability People and Sustainability Planet.

In total around 800 internal controls are defined, implemented, and reviewed. These Internal Controls have been appointed to process owners of each operational unit.

With regard to logical access there are several standard SAP reports prepared monthly. These reports are reviewed by management and Internal Audit reviews these reports. Continuous Auditing has not been implemented, however several internal controls are automated monitored (via exception reporting and RPA).

In addition, for each audit engagement is defined what SAP transactions and the related data can be used for data analytics. The Internal Controls to be tested and audited are defined for each audit engagement. Based on the audit charter of Sappi IAD reasonable assurance is provided and stated in the management reports (used for the annual financial statements as well as the integrated reporting and sustainability reporting – global and regional level).

RPA started during 2018. In the main time there are around 20 RPAs designed and implemented. For example, RPA for (1) travel age analysis, (2) exception identification for payroll, (3) exception identification for procurement, e.g., recorded purchase invoices without adequate three-way match.

Based on the experiences RPA is a very powerful tool and improves the quality of the processes. Specific exception reports as these are created on a daily base and followed up by the staff members.

For each Internal Audit engagement, a scope letter and final report is prepared. In the scope letter the operational risks and related internal controls are recorded (and these are to be audited). The financial performance of the entity (mill, sales office) is audited and standard part of the engagement. Every quarter the results are presented to the Audit and Risk Committee (e.g., planning of engagements versus budget, number of audits finding total and per process, audit coverage, costs, education, staffing and special topics).

### F. Plotting Pilots Results on AMM

The focus group used the data of the Siemens Project, HSP project and the South African Listed Firm to complete the AMM as the provided data was sufficient to make plotting possible. Three of the five selected internal auditors, five selected external auditors (two are working for the Big-4 audit firm and three for non-Big-4 audit firm) and five selected senior managers provided their results on time, resulting in a response rate of nearly 87 %. The outcome is presented in the Table II, which contains an overview of the results per pilot, the reference pilot and average for the seven sections of the AMM.

One internal auditor was not able to plot the domain 7, analytical methods, for Siemens, and the domains 5 and 6, audit and management sharing and management of the audit function of HSP. Based on the guidance the maturity level 1 has been plotted.

Three external auditors were not able to plot some domains. The domains that could not be plotted per participant were audit automation (domain number 4) for Siemens, objective, approach, IT / data access and audit automation (domain number 1, 2, 3, and 4) for HSP and audit and management sharing and analytical methods for the South African listed firm.

The participants of the business were able to plot all values of the 3 pilots based on the data provided.

Based on the analysis of the description of the pilots and the results plotted, it can be concluded that there is a tendency that the Continuum Paradigm is slightly embedded. Some improvements have been achieved since 2008 in the domains of objectives, management of the audit function and analytical methods.

Siemens is one of the global Leading Internal Audit Departments and is seen within global Internal Audit community as an example how to establish a best-in-class Internal Audit Function. This could be an explanation for the rating deviations between Siemens and HSP.

Table II shows the overall results of the 13 participants per pilot and per domain and the case Metcash of 2015 as reference. Table III represents the results of the internal auditors. The results of the external auditors are presented in Table IV. Table V provides the outcome of the business.

TABLE II. RESULTS PILOTS AND AVERAGE AMM

| | Pilot 1: Siemens | Pilot 2: HSP | Pilot 3: South Africa Listed Firm | Average results |
|---|---|---|---|---|
| | 2008 | 2008 | 2022 | |
| Participants | 13 | 13 | 13 | |
| Objectives | 3.3 | 3.2 | 3.7 | 3.4 |
| Approach | 3.9 | 3.0 | 3.4 | 3.5 |
| IT/Data access | 3.9 | 3.5 | 3.7 | 3.7 |
| Audit automation | 4.1 | 3.1 | 3.6 | 3.6 |
| Audit and management sharing | 3.6 | 3.2 | 3.1 | 3.3 |
| Management of the audit function | 3.7 | 2.8 | 4.1 | 3.3 |
| Analytical methods | 3.4 | 3.4 | 4.0 | 3.6 |
| Average per pilot | 3.7 | 3.2 | 3.7 | 3.5 |

TABLE III. RESULTS PILOTS INTERNAL AUDITORS

| | Pilot 1: Siemens | Pilot 2: HSP | Pilot 3: South Africa Listed Firm | Average results |
|---|---|---|---|---|
| Internal Auditors | 2008 | 2008 | 2022 | |
| Participants | 3 | 3 | 3 | 4 |
| Objectives | 2.3 | 3.3 | 3.0 | 3.0 |
| Approach | 2.7 | 2.3 | 2.7 | 2.8 |
| IT/Data access | 3.0 | 3.7 | 3.0 | 3.3 |
| Audit automation | 3.0 | 3.3 | 2.3 | 3.0 |
| Audit and management sharing | 3.3 | 2.0 | 2.2 | 2.8 |
| Management of the audit function | 2.0 | 1.7 | 3.0 | 2.3 |
| Analytical methods | 2.3 | 3.0 | 3.0 | 3.0 |
| Average per pilot | 2.7 | 2.8 | 2.7 | 2.9 |

TABLE IV.   RESULTS PILOTS EXTERNAL AUDITORS

| | Pilot 1: Siemens | Pilot 2: HSP | Pilot 3: South Africa Listed Firm | Average results |
|---|---|---|---|---|
| External Auditors | 2008 | 2008 | 2022 | |
| Participants | 5 | 5 | 5 | 4 |
| Objectives | 2.3 | 1.9 | 2.8 | 2.6 |
| Approach | 3.0 | 1.9 | 2.4 | 2.7 |
| IT/Data access | 3.0 | 2.2 | 2.4 | 2.8 |
| Audit automation | 2.6 | 2.0 | 3.0 | 2.8 |
| Audit and management sharing | 2.3 | 2.4 | 2.2 | 2.6 |
| Management of the audit function | 3.2 | 2.0 | 3.0 | 2.7 |
| Analytical methods | 2.5 | 1.7 | 2.5 | 2.6 |
| Average per pilot | 2.7 | 2.0 | 2.6 | 2.7 |

TABLE V.  RESULTS PILOTS BUSINESS

| | Pilot 1: Siemens | Pilot 2: HSP | Pilot 3: South Africa Listed Firm | Average results |
|---|---|---|---|---|
| Business | 2008 | 2008 | 2022 | |
| Participants | 5 | 5 | 5 | 4 |
| Objectives | 2.3 | 1.9 | 2.1 | 1.9 |
| Approach | 2.4 | 2.1 | 2.2 | 2.0 |
| IT/Data access | 2.3 | 1.9 | 2.5 | 2.0 |
| Audit automation | 2.9 | 1.6 | 2.0 | 1.8 |
| Audit and management sharing | 2.2 | 2.1 | 2.0 | 1.9 |
| Management of the audit function | 2.3 | 2.0 | 2.5 | 1.8 |
| Analytical methods | 2.2 | 2.7 | 2.9 | 2.3 |
| Average per pilot | 2.4 | 2.0 | 2.3 | 1.9 |

The core team of researchers was also interested if there were major deviations between the three professions internal auditors, external auditors and business. The expectation of the core team of researchers was that the results of the internal auditors will be higher than the rating of external auditors and business. Based on the results and the analysis this seems to be indeed the case.

The results of each category have been collected and the average results per category have been calculated. The results are presented in Table VI. About HSP there is a small gap between the rating of internal auditors versus the external auditors and business.

Tables VII, VIII and IX present a table of the results of the three pilots Siemens, HSP and the South African Listed Firm as plotted per profession and per domain.

TABLE VI.   RESULTS 3 PILOTS INTERNAL EXTERNAL BUSINESS
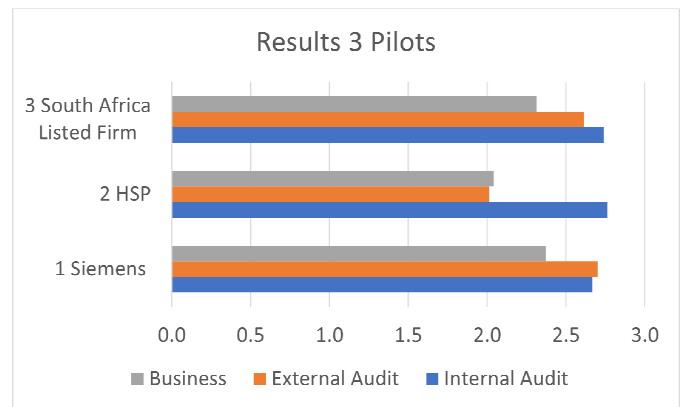


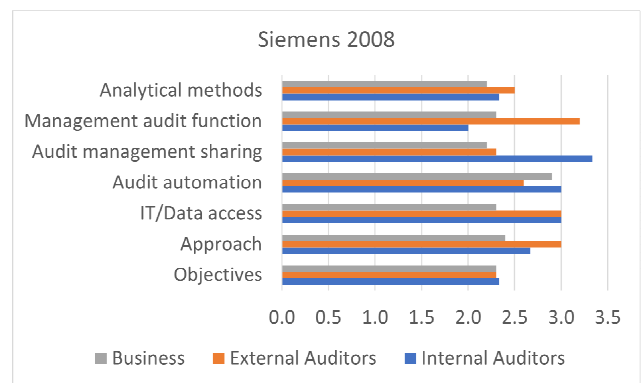TABLE VII. RESULTS OF SIEMENS 2008
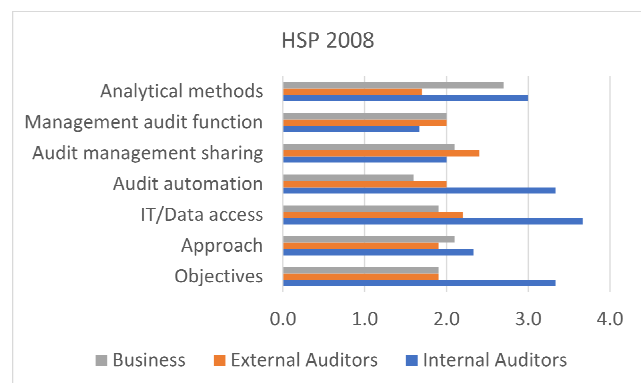


TABLE VIII.        RESULTS OF HSP 2008

TABLE IX. RESULTS OF SOUTH AFRICAN LISTED FIRM 2022



Table X provides insight in the elements that have been in scope of the pilot. The first column of Table III refers to the main scope of the pilot, Assurance, Audit or Monitoring. The second column of Table III relates to the part of the Continuum Paradigm in scope of the pilot, e.g., CA, CAss, CM, CCM and CRe and in addition related elements such as process data, general IT controls, Internal Control System and Enterprise Risk Management system. The elements process data, general IT controls, Internal Control System and Enterprise Risk Management system are added as these are relevant for the external audit to decide the final level of assurance of the audit. The elements process data and general IT controls are defined further in detail. In case 'In scope' is mentioned the related element was part of the pilot. All the other elements were not part of the pilot and for that reason no research has been performed to the Continuum Paradigm based on a holistic view.

TABLE X. SCOPING PILOTS ELEMENTS CONTINUOUS

| Scope | Part | IT or Data | Results of the Pilots | | |
|---|---|---|---|---|---|
| | | | Pilot 1 Siemens | Pilot 2 HSP | Pilot 3 SA Listed Firm |
| Assurance | Cre | | | | |
| | Cass | | | | |
| Audit | CA | | In scope | In scope | In scope |
| Monitoring | CM | | In scope | In scope | In scope |
| | Process Data | Financial Data | | | In scope |
| | | Non-Financial Data | In scope | In scope | In scope |
| | General IT Controls | Logical Access | In scope | | |
| | | Physical Access | | | |
| | | Back-up & Recovery | | | |
| | | Change Management | | | |
| | Internal Control System | | In scope | In scope | In scope |
| | Enterprise Risk Management System | | | | |

## V. RESULTS

The overall outcome of plotting three pilots including the reference pilot is that the overall average maturity level is nearly stage 3: Monitoring. The level of stage 4: Continuous Audit has still not been achieved yet.

In total 15 participants have been invited to plot the three pilots in the AMM. Participants from internal audit profession, external audit profession and business with a previous background in auditing have been invited. For each profession 5 participants have been selected. The response rate of the participants was nearly 87 %.

The first conclusion is that the rating of the internal auditors, external auditors and business are close, however in general, the rating of the internal auditors is higher than the one of the external auditors and business. A possible explanation could be that the own profession is less critical and more positive of its own performance and results. The second conclusion is there is tendency that the maturity level of the Internal Audit function improved. This could be explained by the fact that the profession of auditing further developed, further precise and detailed guidance has been implemented and that the IT developments and IT solutions available at the market support the Internal Audit function to implement CM, CCM and CRe.

Regarding the Pilot HSP there is a small gap between the outcome from the internal auditors versus the outcome external auditors and business. The AAM overall results of the pilots Siemens and South African Listed Firm are per domain closer.

As the description of the South African Listed Firm is the most recent one, it includes new IT technology like RPA, data analytics and process mining. This results in a higher rating, however, it seems that CA, CAss, CM, CCM and CRe are still not fully embedded in the Internal Audit function of the South African Listed Firm.

There are limited pilots and studies with sufficient detailed data and information available to plot the results and outcome on the AMM. The analysis of the three projects makes clear that the research on CM and CA is still scarce and in maturation and mainly related to non-financial data.

All pilots used for this experiment are related mainly to CM of non-financial data. CAss and CRe are not part of the selected pilots. No pilots or studies based on actual implementations have been set up to perform research in the fields of CA, CAss, CM, CCM, and CRe as one holistic and fully integrated process. To achieve a successful implementation of the continuous concept it requires an integrations and alignment of all elements of the chain from the start of selection of the data until providing CAss and deliver CRe.

## VI. FUTURE RESEARCH

There is an increased need and growing pressure from stakeholders for receiving a continuous flow of assured data and information, specific non-financial data will become relevant. Compliance, new laws and regulations will become applicable requesting assurance services of financial and non-financial data. Some examples are: (1) the development of Corporate Sustainability Reporting, the EU regulation applicable as of 2025 regarding Environmental Social and Governance (ESG), (2) the monitoring of General Data Protection Regulation and current (3) IT developments, e.g., RPA, data mining, data analytics. All these new

developments included reporting reliability of financial data as well as non-financial data.

CCM can be applied to achieve insight in the existing level of assurance, to make the internal audit function efficient and possibly, even more effective. Auditors are skeptical about reliability of automated controls. There is a need for general audit and assurance models which fit system-based auditing approaches and a Continuous Integrated Assurance Concept for financial as well as non-financial data.

Further research is needed regarding new IT developments, e.g., blockchain solution, data analytics, RPA, etc. to increase the reliability of the data, financial as well as non-financial data, and the overall level of trust. The outcome could be used to fine-tune the AMM and provide guidance for further development of the Internal Audit function.

New guidance and auditing standards should be defined and implemented in close cooperation and partnership with the developers, producers, users and end users of CA, CAss, CM, CCM and CRe to control and manage the levels of expectation. Further research is needed to get insight in the bottlenecks of why CA, CAss, CM, CCM and CRe has yet not as a fully holistic process been implemented.

## VII. CONCLUSION

The overall outcome was that the average maturity level for CM and CA reaches nearly stage 3: Maturing. The overall average maturity level for CAM and CA increased slightly during the period 2008 and 2022.

No research was performed based on a holistic and fully integrated process including the status and maturity level of the Line of Assurance at the client.

Limited research has been performed on CCM, CM, CA, CAss and CRe of financial data.

A certain minimum level of the Line of Assurance at the client will be required to implement CCM, CM, CA, CAss and CRe. Combined Assurance has not a major impact on the way or level of implementation CCM, CM, CA, CAss and CRe.

The holistic and fully integrated process could be very helpful for organizations accountable for reporting of sustainability, non-financial data across the organizations, e.g., usage of $CO_2$ in the supply chain process or energy process, wastewater management, employees (own) and contractors Lost Time Injury Frequency Rate (LTIFR). Research could be performed in combination with automated audit standards and assurance standards to achieve CAss.

To meet the upcoming requirements of CCM, CM, CA, CAss and CRe a comprehensive holistic and fully integrated approach would need to address Line of Assurance testing, CCM testing, continuous internal control testing, continuous data testing, continuous transaction testing and continuous assurance testing.

The AMM could support academics by research and the business by further development of new IT concepts and IT solutions.

## REFERENCES

[1] E. Curfs, E. Mantelears, and M. Zoet, "How to Plot Current Pilots on the Audit Maturity Model? The Continuum Paradigm," in Proc. eKNOW 2022, pp. 12-17.

[2] E. Mantelaers and M. Zoet, "Association for Information Systems AIS Electronic Library (AISeL) Continuous Auditing: A Practical Maturity Model," 2018. [Online]. Available: https://aisel.aisnet.org/mcis2018/40

[3] M. A. Vasarhelyi, M. Alles, S. Kuenkaikaew, and J. Littley, "The acceptance and adoption of continuous auditing by internal auditors: A micro analysis," International Journal of Accounting Information Systems, vol. 13, no. 3, pp. 267–281, Sep. 2012, doi: 10.1016/j.accinf.2012.06.011.

[4] M. A. Vasarhelyi, S. Kuenkaikaew, J. Littley, and K. Katie Williams, "Continuous Auditing technology adoption in leading internal audit organizations," 2008. [Online]. Available: https://www.researchgate.net/publication/229004600

[5] G. Locke and P. D. Gallagher, "Guide for Applying the Risk Management Framework to Federal Information Systems," 2010. [Online]. Available: http://csrc.nist.gov/publications.

[6] AICPA, Audit Analytics and Continuous Audit: Looking Toward the Future. 2015.

[7] M. A. Vasarhelyi, "Chapter 12 Concepts in continuous assurance."

[8] M. G. Alles, A. Kogan, and M. A. Vasarhelyi, "Putting Continuous Auditing Theory into Practice: Lessons from Two Pilot Implementations," 2008. [Online]. Available: www.businessfinancemag.com

[9] C. A. Hardy and G. Laslett, "Continuous auditing and monitoring in practice: Lessons from Metcash's business assurance group," Journal of Information Systems, vol. 29, no. 2, pp. 183–194, Jun. 2015, doi: 10.2308/isys-50969.

[10] K. Singh, P. J. Best, M. Bojilov, and C. Blunt, "Continuous auditing and continuous monitoring in ERP environments: Case studies of application implementations," Journal of Information Systems, vol. 28, no. 1, pp. 287–310, 2014, doi: 10.2308/isys-50679.

[11] C. Rogers, "Continuous monitoring of business controls: A pilot implementation of a continuous auditing system at Siemens Discussant's comments," International Journal of Accounting Information Systems, vol. 7, no. 2. Elsevier Inc., pp. 167–169, 2006. doi: 10.1016/j.accinf.2006.03.006.

[12] M.E. King, KING IV, Report on Corporate Governance for South Africa 2016, Available: King IV Report on Coproate Governance for South Africa (ymaws.com)

TABLE XI.                                   AUDIT MATURITY MODEL

| Satge | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Domain | *Traditional audit* | *Emerging* | *Maturing* | *Continuous audit* |
| *(1) Objectives* | - Assurance on the financial reports presented by management | - Effective control monitoring | - Verification of the quality of controls and operational results | - Improvements in the quality of data<br>- Creation of a critical meta-control structure |
| *(2) Approach* | - Traditional interim, and year-end audits | - Traditional approach with some key monitoring processes | - Usage of alarms as evidence<br>- Continuous control monitoring | - Audit by exception |
| *(3) IT/Data access* | - Case by case basis<br>- Data is captures during the audit process | - Repeating key extractions on cycles | - Systematic monitoring of processes with data capture | - Complete data access<br>- Audit data warehouse. Production, finance, benchmarking and error history |
| *(4) Audit automation* | - Manual processes & separate IT audit | - Audit management software<br>- Work paper preparation software | - Automated monitoring module<br>- Alarm and follow up process | - Continuous monitoring and immediate response<br>- Most of audit automated |
| *(5) Audit and management sharing* | - Independent and adversarial | - Independent with some core monitoring shared | - Shared systems and resources with natural process synergies | - Purposeful parallel systems and common infrastructures |
| *(6) Management of the audit function* | - Financial organization supervises audit and Matrix to Board of Directors | - Some degree of coordination between the areas of risk, auditing and compliance<br>- IT audit works independently | - Internal Audit and IT audit coordinate risk management and share automatic audit processes<br>- Auditing links financial data to operational processes | - Centralized and integrated with risk management, compliance and SOX / layer with external audit |
| *(7) Analytical methods* | - Financial ratios | -Financial ratios at sector level / account level | - KPI level monitoring<br>- Structural continuity equations<br>-Monitoring at transaction level | - Corporate models of the main sectors of the business<br>- Early warning system |