Continuous Monitoring and Auditing in Municipalities

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ABSTRACT

Tools and techniques for monitoring and auditing continuous streams of data are increasingly being used. However, adoption has only been investigated in the private sector. In this paper we examine the feasibility of continuous auditing and continuous monitoring in the public sector, specifically for municipalities in the Netherlands. A multiple case study is conducted about the opportunities and needs of continuously monitoring and assessing financial data concerning the social domain: care-related and social services, which have recently been decentralized from the national government to the municipal level. Interviews were held with representatives of six municipalities, administrative bodies, and an accounting firm. The research indicates that continuous monitoring is feasible, and that there is a need for continuous monitoring in the public domain. The ease of adoption depends to a large extent on the choice of whether and how a municipality wants to collaborate in offering social domain services.

CCS CONCEPTS

• **Applied computing** → *E-government*;

KEYWORDS

Continuous auditing, decentralization, social domain

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1 INTRODUCTION

The world is moving fast, producing a continuous stream of data. Important decisions depend on the reliability of data streams. Hence, tools and technologies for monitoring and assessing essential properties of these continuous streams of data have been developed. Since the 1990s there has been a lot of research into technologies such as Continuous Monitoring (CM) and Continuous Auditing (CA) [1, 3, 11, 35, 46, 47]. The purpose is to provide assurance (certified certainty) about properties of data streams at or near real time [2, 22, 50]. Regarding governance, CM is usually applied by management, and CA is applied by the internal audit department and/or an external auditor, in line with [28].

Compared to the traditional audit of periods in the past, continuous monitoring and auditing may offer several benefits [11, 26, 43]: (1) deviations and incidents are detected at or near real time, before they escalate and turn into a real problem, (2) evidence of the entire population of behaviour is being verified, not just a sample, (3) the system automatically detects deviations or patterns of behaviour, and can send warnings or signals, (4) evidence is collected and made available in a dashboard, showing a shared representation of reality to stakeholders, (5) using the dashboard, stakeholders can learn and improve, (6) auditors and domain experts will only have to deal with deviations and exceptions, provided adequate quality of evidence.

Continuous auditing and monitoring technologies are originally developed for financial auditing, but are also used for conformance checking [20, 36], contract management [14] and business process improvement, e.g. [48]. We would expect such tools to be useful in the public sector too. However, recent surveys [12, 31], show that most research in this area has been conducted in the private sector, with some exceptions [26, 49]. The feasibility and potential benefits of continuous monitoring and auditing in the public sector are therefore still largely unclear.

In this paper we examine possible adoption of continuous monitoring and auditing in the public sector, specifically for municipalities in the Netherlands. We have conducted case studies among five municipalities, care related administrative bodies, and an accounting firm, investigating the feasibility of automatically monitoring financial data concerning the procurement, delivery and payment of care-related services from the social domain.

In a long process that culminated in 2015, social support and care-related services, referred to as the 'social domain', have been decentralized from the Dutch national government to the municipal level [29, 37], under the WMO (Social Support Act) of 2015 and Jeugdwet (Youth act) of 2014. Municipalities are now responsible for organizing care and social services for their citizens, and for controlling the corresponding budget. This is a complex task. Services are offered by many different kinds of care providers. The social domain is heavily regulated. Municipalities in a region often collaborate in order to offer a comprehensive care portfolio [37]. However, the boundaries of regions for different kinds of services do not always align. So for a single client, there can be local differences in the way care is being offered, provided, and paid for. Because of the novelty and complexity of the social domain many municipalities are struggling to manage their financial situation. The expenses of the social domain cover a large part of the annual budget of a municipality. In principle, budget to fund these expenses is provided by the national government, but only afterwards, when

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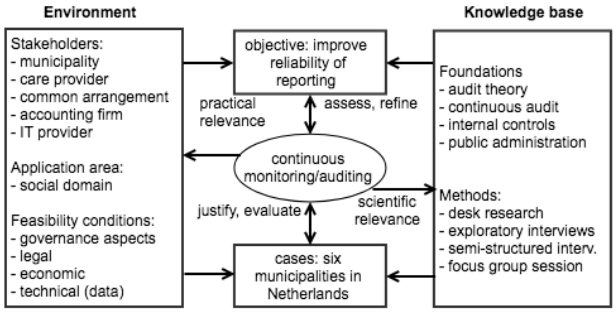

Figure 1: Research setting; diagram based on [25].

the municipalities can demonstrate that the budget was used legitimately. As a result, many municipalities did not get approval for their annual financial accounts over the year 2015 [23].

Public accountants who have many municipalities as their clients, have recognized this problem. This research was conducted in collaboration with experts from such an accounting firm, Baker Tilly Berk. The research set-up is meant to be generic. The study aims to answer the following research question:

> Is it feasible to apply continuous monitoring or auditing in municipalities in the Netherlands, in order to improve reliability of financial reporting about the social domain?

A multiple case study approach is used as research design, compare [56]. To study a system in context, researchers often use qualitative research methods, in the form of case studies [39]. That is also true here: we study the artefact of continuous monitoring and auditing, but these are intertwined with the environment (municipalities), and the application area (social domain). We have made a diagram to illustrate the research setting: the artefact to be studied (middle), objectives (top) and case selection (bottom), environment (left), knowledge base (top right), and research methods (bottom right). Even though this research is not strictly speaking design science, the diagram is inspired by Figure 1 of Hevner et al [25]. Note that design science often triggers more generic knowledge questions [54]. Here we focus on knowledge questions concerning legal, economic and technical feasibility, the reasons for adoption, and the governance aspects of deploying continuous monitoring and auditing. We also look at the impact of forms of collaboration among municipalities. For data collection we use a combination of desk research, documentation, exploratory interviews, semi-structured interviews and focus group sessions, compare [39]. We interviewed representatives of six municipalities, a common arrangement (a form of collaboration) and experts from Baker Tilly Berk, an accounting firm with many municipalities among its clients. The purpose of collecting data by different methods and from different sources, is to cross-verify findings (triangulation) [39]. The data was collected in the period January-June 2017. For more details, see [21].

The remainder of the paper is structured as follows. Section 2 contains an overview of the literature. Section 3 explains the application domain and the outcomes of the case studies. Section 4 contains a discussion of these results, and of the feasibility of continuous monitoring and auditing in general.

2 THEORETICAL BACKGROUND

In this section we present some background to conceptualize and understand the cases and the artefact. We first deal with audit theory and internal controls, and explain the claimed benefits of continuous monitoring and auditing. After that we explain details of public administration in the Netherlands, specifically about the funding of municipalities and about decentralization in the social domain, and about the procurement of care services.

2.1 Auditing and internal controls

Municipalities are accountable for proper allocation of their annual budget and achieving policy objectives. So they have to provide financial reports. An auditor is called in to verify the reports and provide assurance about their reliability. Generally an audit involves three elements [32]: (1) an assertion made by the management of an organization about some object (2) evidence that makes it possible to verify that assertion, and (3) generally accepted criteria, against which the assertion can be verified. This suggests a paradox: the evidence is generated by the organization to be audited and can in principle be manipulated! The paradox can be solved by the organization implementing internal controls [18]: organizational, procedural or technical measures to guarantee that the evidence is reliable (correct and complete). Consider for example controls like segregation of duties, data collection immediately at the source, entry level controls, application controls, audit trail, access control, baseline security, back-up and retrieval, clear objectives, risk management, and monitoring [44][Ch7-11]. Controls are context dependent. In practice an auditor or inspector will have to verify whether the internal controls are adequate to meet the risks for that organization, whether they have been implemented and whether they have been operationally effective for the period under investigation [6]. In general, those internal controls that are built into information technology and processes are considered more reliable than manual controls, as they are harder to manipulate. Some controls are even said to be 'irreplaceable' [6]: without such guarantees, the audit cannot be re-performed on the basis of the evidence alone. For example, if a data set is generated without the expected segregation of duties, the auditor may not rely on it.

2.2 Continuous monitoring and auditing

If incidents are discovered when they happen, they can still be stopped. So it makes sense to combine monitoring techniques, with internal controls and auditing standards. Researchers have endorsed this idea for a long time, e.g. [1, 3, 11, 35, 46, 47]. The purpose is to provide assurance over continuous data streams, or briefly, continuous assurance [2, 22, 50]. Here is a commonly used definition: "A continuous audit is a methodology that enables independent auditors to provide written assurance on a subject matter, for which an entity's management is responsible, using a series of auditors' reports issued virtually simultaneously with, or a short period of time after, the occurrence of events underlying the subject matter." [15].

In the definition, what does 'virtually simultaneous' mean? We settle for a practical definition. Many processes have a natural frequency. For instance, human resource processes have a monthly cycle. The events in a trading room in a bank run at the tenths

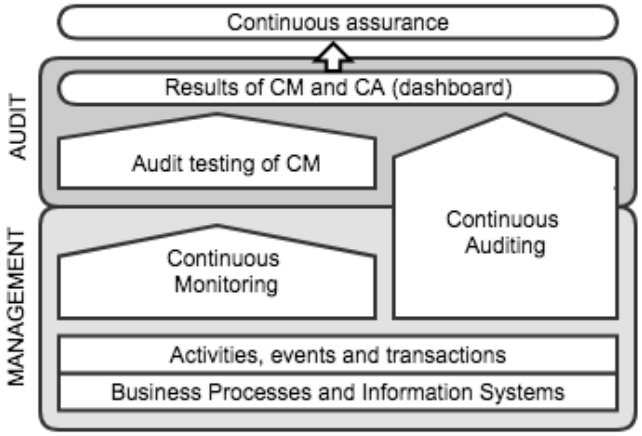

Figure 2: Responsibilities for CM and CA [16]

of a second. We call monitoring 'continuous' if and only if frequency of testing is higher than the natural frequency of the process. Moreover, all evidence is taken into account, up until a specific moment. Furthermore, continuous monitoring entails direct processing; there are no delays in dealing with incidents.

There is a distinction between control monitoring and data assurance. Both elements are needed, and need to be embedded in a control environment with proper risk management [3][p 6]. Continuous (control) monitoring verifies whether the system of controls that underlies the reporting process continues to be operational. Many of these checks can be automated. Continuous data assurance is provided by business rules or analytic procedures, that check whether data conform to certain conditions.

Continuous monitoring is usually the responsibility of management, as this concerns the internal controls that are built into the business processes. Continuous data assurance, also called continuous auditing, is usually performed by the internal audit department, or by an external audit firm, or both. This distribution of responsibilities is shown in Figure 2. It roughly corresponds to the responsibilities of the Three Lines of Defence model [16].

The outcomes of the automated monitoring and analytics tests are typically visualized on a dashboard, accessible to all parties. Several kinds of analysis can be performed [26]:

- Time series and trends: is performance developing naturally or are there abrupt changes or incidents?
- Alerts: when a control is breached or performance reaches a critical level, a signal or warning is generated.
- Reconciliation: compare variables according to underlying causal, fiscal, or trading relationships.

Reconciliation is checked by equations that capture essential laws of the task or domain [51][]p14]. One can use formal models of the flow of money and goods or services in an organization to derive such relationships [13, 52].

It is an open question how to make the final step from CA and CM to continuous assurance, because in the audit domain the term assurance demands a written report. Some authors [33] suggest a dashboard architecture to provide continuous confidence over streams of data, combined with an automated work-flow to generate a written report 'on demand'.

Benefits [27, 35, 38]

- Enhances effectiveness of internal controls
- Provides critical evidence
- Improves reliability of data
- Increases operating effectiveness
- Early detection of errors
- Organizational learning from the anomalies
- Additional management information, more frequent reports
- Covers entire population of transactions, not a sample
- Improves decision making if right data are monitored
- Documentation is archived centrally
- Monitoring and checking take less time and effort (automatically)
- Less overhead costs (less communication needed)
- Information shown on a dashboard which leads to a shared understanding among stakeholders

Barriers [19, 27, 43]

- Misunderstanding of continuous monitoring and continuous auditing and of implementation issues
- Perceived impact on the enterprise related to costs, head count, audit plans, workload, etc.
- Lack of willingness among people in the organization to develop and adopt technology
- No support by top management
- Negative experiences with previous IT-based systems, will also affect CM and CA decisions and initiatives.
- The need for time and commitment to realize the benefits of CM/CA impacts its implementation.

Table 1: Claimed benefits of CA and CM [19, 27, 35, 38, 43]

2.3 Benefits of CA and CM in general

We have conducted a literature review, see [21], based on a keyword search in bibliographic sources, and cross referencing with existing reviews [8, 12] The review makes clear, that most of the research on continuous auditing and continuous monitoring is theoretical, focusing on the concepts, potential benefits, measuring levels of progress, or specifying technical aspects [8, 12]. There is limited research on CA and CM in practice, except for pilots and case studies, mostly in the context of ERP systems [1, 3, 24, 46]. Moreover, there is limited understanding of how to adopt CA and CM effectively and how to leverage it [53]. Despite the limited scientific research on implementation and adoption, it appears that companies are increasingly aware of the benefits of CA and CM, and are willing to invest [34, 41]. Reviews also show that research into CA and CM has mostly been conducted in the private sector [8, 12], specifically in the financial industry. There are some exceptions of studies in government, but these are specifically about adoption of continuous control monitoring for regulatory compliance: for food and health safety [5, 26], and for customs supervision [49].

Based on the literature review[21], we collected the following list of claimed benefits, and barriers (Table 1).

2.4 Benefits of CA and CM in the Public Sector

We believe that the benefits of CM and CA also apply to the public sector, and not just for regulatory supervision, as [26, 49]. There are a number of reasons for this.

First, government organizations are themselves also subject to many rules and regulations [40]. In particular, the activities performed by government officials (e.g. collecting information; decision making; monitoring behaviour; enforcement actions) are mandated by law. Therefore, legitimacy of those activities must be demonstrated, as well as compliance to other regulations. For example, municipalities must ensure the confidentiality of data entrusted to them by citizens, as part of the social domain.

Second, government organizations are accountable to the public for the allocation of budget and for achieving policy objectives [7]. For municipalities, the city council is monitoring budget allocation, financial stability and achievement of policy objectives. In practice, this means that municipalities have to provide regular reports, for instance about the financial situation.

Third, public services are delivered to citizens, not customers, as in the commercial domain [55]. Unlike customers, citizens have no choice to go elsewhere. So public services must be accessible to all citizens. In case public service delivery is outsourced, as in the case of the care services discussed here, quality of service must still be enforced by the government.

Fourth, the government is expected to contain risks for society [4]. This involves safety and security, food safety, health, quality of care. It also involves protection of fundamental rights, such as justice, or privacy. This warrants much regulation. Note in this respect that the government plays several, possibly conflicting roles: orchestrator, service provider, principal and regulator.

So there are many reasons for a public organization to monitor compliance or legality of steps in a process, and of spending budget. According to Bovens [7] public accountability can be achieved by a kind of dialogue, in which a forum of stakeholders has the opportunity to critically assess behaviour, demand explanations, and finally pass judgement. In case of municipalities the typical forum is the city council, on behalf of. citizens. Such an accountability dialogue can be facilitated by CM and CA technology and governance mechanism, compare [10]. A critical dialogue about CA and CM would extend the yearly dialogue about the financial statements, but the advantage is that issues can be discovered, challenged and solved much faster. In addition, the data produced by CM and CA could facilitate learning and improvement. The external auditor can still provide assurance, but now based on evidence taken from the dashboard, and the way it was collected and processed. Moreover, the auditor contributes necessary expertise in how to interpret and evaluate financial data.

This summarizes the promise of CM and CA.

2.5 Procurement of Care services

In the case we focus on financial reports about the procurement, delivery and payment of care related services. Therefore, it makes sense to review some relevant literature about procurement and contract monitoring.

Kartseva et al [30] study the control structure of public health care funding. Unlike a normal transaction, in case of public procurement of care services, there is a triangular structure (see Figure 3): the municipality is purchasing care services from care providers, on behalf of their citizens. Only some citizens will need such care. The care services are paid by the government

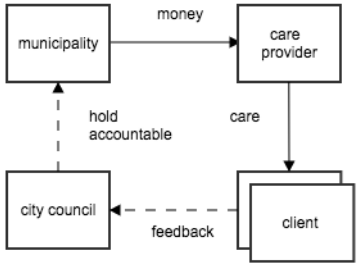

Figure 3: Procurement of care services

from public funds; not by the clients involved. This indirection may explain issues with service quality (no direct feedback), and financial pressure (clients don't see the real costs). Usually, only those clients who really need it, are entitled to care. Therefore, a request for care must first be approved by a professional (physician, social worker). These professionals have no incentive to control the budget. Instead, they have a professional task to arrange the appropriate type of care for their clients.

Christiaanse and Hulstijn [14] study a case of automated contract monitoring for public transport for the elderly and disabled. Like care, this is a highly regulated market. And also in this case, the services are procured by a collaboration between several municipalities in a region. These public transport contracts cover an enormous volume of trips. To handle the complexity, contract monitoring can only be performed automatically. Every month, the transport provider sends an excel sheet along with the invoice. It contains data about the trips that were performed, the passenger details and routes, and all other variables that are needed to verify accuracy and legitimacy of the invoice, before it is paid. On the basis of this data, software can automatically verify the properties that determine whether these trips are entitled to be funded, and can therefore be paid. A governance procedure specifies how to deal with exceptions and possible conflicts. In this case we expect a similar governance situation, although now the reporting is supposed to be continuous, and not monthly.

3 CASE: SOCIAL DOMAIN

In this section we describe a possible application scenario of CM and CA to financial reporting about care. All descriptions and observations in this section are based on interviews with representatives of six municipalities, a common arrangement, and experts from an accounting firm, as well as desk research and site visits. The interviews were semi-structured, guided by a number of issues or topics to be discussed. All interviews were recorded. Meeting notes were verified by the interviewee. Details about data collection can be found in [21].

3.1 Stakeholders and interests

Table 2 summarizes the main actors or stakeholders, with their tasks, power and main interest in the project, compare [9]. The municipality organizes the care and pays for it. Municipalities need to perform the tasks of the social domain within a fixed budget that they receive each year from the municipalities fund, managed by the national government [42]. Responsibility for the budget also means controlling the costs. Some municipalities stay within budget and have therefore other needs of monitoring, compared

to municipalities who utilize more care than budget. They need to monitor their financial transactions more closely.

The care provider provides care. Many municipalities collaborate in a common arrangement, so they provide a larger care offer to their citizens and can reach economies of scale. That means that, in effect, they have delegated procurement, contract monitoring and payment to the common arrangement. Formally, the municipality council issues a mandate, in which it delegates the relevant tasks and rights to the common arrangement. Note moreover, that because of this collaboration also the complexity of decision making increases. For major decisions, consensus needs to be reached among all of the participating municipalities.

The public accountant has the task and also the expertise to assess the reliability of financial reports. It has been observed that the larger accounting firms in the market are relatively less willing to audit municipalities . Smaller sized accounting companies have to take over those clients, since it is mandatory for municipalities to have an external accountant check the financial statements . However, the smaller firms simply do not have the capacity to audit all municipalities. Continuous control monitoring and auditing could help municipalities to be more 'in control' of their finances. It will allow the audit to be performed in a more efficient and effective manner. Besides, it could help municipalities to improve their processes and gain more insight in the distribution of resources in the social domain.

3.2 Environment

In our case studies, the environment of adopting CM and CA is determined by the municipality (Table 3). Municipalities differ a lot in the way they operate. The main differences concerning the social domain can be described in terms of the following variables, see [29, 37]. The variables are motivated below.

- *Size*: large or small
- *Location*: rural or urban
- *Procurement specialized care*: common arrangement or not
- *Control approach*: tight control or relationship building
- *Risk perception*: aware of the risks or trust-based
- *Budget Pressure*: some budget left or not
- *Monitoring Need*: financial controls or also client satisfaction
- *Key performance indicators*: defined or not
- *Feasibility*: data available or not, support or not

Municipalities need to perform the tasks of the social domain within a fixed budget, which they receive each year from the central government. Responsibility for allocation of budget also means controlling the costs. Budget allocation is related to the location, size and history of citizens who needed care. The size and location of municipalities could have an influence on whether municipalities have difficulties to stay in budget and attain the decentralization goals of the youth domain. It is likely that rural areas have different problems concerning youth aid than municipalities from cities. These differences also determine whether municipalities want to have close control and want to use continuous monitoring technology to get more grip on the data.

Most municipalities choose to gain from economies of scale by procuring specialized care in a common arrangement. However, there are also municipalities who want to arrange the whole portfolio of youth care services themselves and retain control. They believe it is better to invest in a good relationship with the care providers, so the quality of care improves. Also in that case, scale matters: a larger area also means economies of scope.

Concerning risk perception, some municipalities have a tight control environment and are very aware of the risks, while others have an environment based on trust. This determines whether they need continuous monitoring and if so in what sense.

Some municipalities need to focus on financial aspects because they do not have enough budget left. Others still have budget to spare. This affects the monitoring need too. Some municipalities know exactly what they would like to monitor, but they don't know how. Other municipalities are still in the process of trying to find the optimal form of providing care to their citizens. That means that they do not have key performance indicators defined.

Concerning feasibility, there are several aspects that matter. Is data available and is it technically possible to use CM? Also support from the organization is an important factor to consider.

The outcomes of the interviews with six municipalities and a common arrangement (called GR-JR) are summarized in Table 2.

3.3 Problem

The problem is to establish reliability of financial reporting by municipalities over the procurement, delivery and payment of care-related services in the social domain.

3.4 Proposed solution: CM and CA

The proposal is as follows. First, to apply CM at municipalities, specifically built into the financial processes that are concerned with procurement, delivery and payment of care related services. Alternatively, to apply CM at the common arrangement, for those municipalities which collaborate and procure care collectively. Second, to apply CA at the internal audit department (or similar) of the municipality, and in parallel, at the external accountant, so that reliability of reports can be established at or near real time.

In either case, a dashboard is developed with several performance indicators. These fall into two categories: process monitoring indicators, containing meta-data about controls (authorizations; segregation of duties; audit trail) and data assurance indicators about care expenditure. Table 3 contains a sample of performance indicators about expenditure, with the associated data sources. Figure 4 shows a simplified process model for the care provided under the Youth Act. The other processes have a similar structure. The process starts with a request for care or support, from a citizen. After that, in line with [30], a professional needs to approve the request and decide if the care is really needed. After that, a specific type of treatment is assigned to the (now) client. At this point, the expected value of the treatment can be predicted. Next, the care services are delivered. Regularly (e.g. monthly), invoices are paid. At this point, the actual value can be calculated.

The financial process involves steps for approving an invoice and making it payable, and preparing reporting. These steps can only be made, if the relevant data is available. Care providers and municipalities exchange data by means of a special infrastructure, following the so called Message Traffic standard[1]. This data

[1]Berichtenverkeer: *https://vng.nl/berichtenverkeer-wmo-en-jeugdwet*

Stakeholder	Task	Power	Interest
Municipality	Responsible for care policy, quality of care, budget, procurement of care, monitoring of care providers.	Short lines to citizens local knowledge opportunities for customized care	Being 'in control' concerning the quality, costs and legitimacy of care Decrease administrative burden and audit costs Gain insight in care spending, so resources can be deployed where they are most needed.
Care provider	Provide care to citizens of the municipality, sharing needed information with the municipalities	Provide care; access to client records	Diminish administration costs and needs, so that they can focus on providing good quality of care.
Common arrangement:	Intermediary between municipality and care providers. Often responsible for procurement of specialized youth care, payment and contract management with care providers	Economies of scale Economies of scope (larger offer of care services) Easier to deal with fluctuations in demand of expensive care and to share the risks of fluctuations together.	Decrease costs of care Improve monitoring and budgeting of specialized youth care; share available information with municipalities. Transparency; their existence depends on satisfied municipalities.
Accountant	Verify financial statements of municipalities and common arrangements Give advice to municipalities about CM and CA system	Financial and audit expertise, in particular if care is procured, delivered, and paid according to the rules. Qualified to provide assurance on financial statements. Expertise in CM and CA	Help municipalities monitor and audit their internal processes, to make the audit more effective and efficient. Offer a distinctive service to clients; gain experience in setting up CM and CA in the public domain

Table 2: Stakeholder Analysis

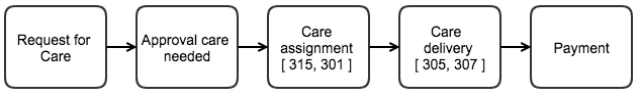

Figure 4: Simplified process model of care provisioning; codes refer to Message Traffic standard

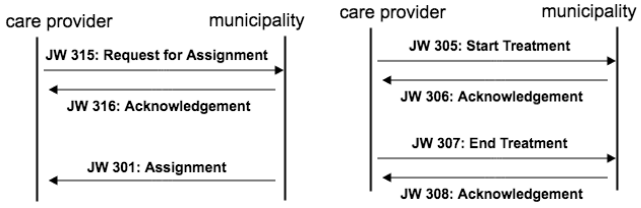

Figure 5: Examples of message traffic

representation standard was developed by the Netherlands Care Institute, in collaboration with municipalities. The purpose of the standard is that care providers and municipalities can exchange data, in a secure and reliable fashion. Examples of message exchanges are shown in Figure 5. The standard provides means to identify, authenticate and authorize parties, and interfaces to commonly used software packages. For example, there are standard codes for start of treatment, end of treatment, and invoices, but the specific content of messages may differ per region. This depends on the funding method. The region West Brabant West works with treatments based on nine client profiles and four intensity levels. Before that, in 2015, they used an output methodology, based on $P \times Q$, i.e. price times quantity. In this case no information is exchanged about client profiles, but only about product codes that indicate which type of care a client received. When the change was made some treatments needed to be paid according to the rules set in the old system and other treatments needed to be paid according to the new system.

Confidentiality plays an important role. Care providers and social workers have a professional relationship with their clients, based on trust. Compare the Hippocratic oath. For that reason, care related personal data must remain confidential. This demand is reflected in laws and regulations, like the General Data Protection Regulation GDPR [17]. Data protection laws recognize that medical or care related data is especially sensitive.

That means some of the treatment data that would usually be needed by the financial department or the accountant to verify accuracy and legitimacy of an invoice, is not available. For example, suppose the financial controller suspects that a wrong tariff code is used for a client, or that too much sessions have been charged. Now, because the underlying data is not available, this will mean that they have to contact the care provider (whose expenses are audited) or the professional who approved the care request. This also explains the complexity of the process. It also means, that for financial controls, the accountant has to rely much more on the controls and verifications that are built into the process, such as authorization and segregation of duties, and much less on evidence to be verified later. This explains the need to monitor controls.

Indicator	Data Source
Number of new assignments	Number of 301 messages in period
Expected value of new assignments	Sum total of expected value of 301 messages in period
Number of pending assignments	Number of 301 messages at date, with no 305 or 307 message
Value of pending assignments	Sum total of expected value of 301 messages at date, with no 305 or 307 message
Clients in treatment	Number of 305 messages at date, with no 307 message
Value of clients in treatment	Sum total of expected value (from 301 message) of 305 messages at date, with no 307 message
Number of newly started treatments	Number of 305 messages in period
Value of newly started treatments	Sum total of expected value (from 301 message) of 305 messages in period
Number of ended treatments	Number of 307 messages in period
Expected value of ended treatments	Sum total of expected value (from 301 message) of 307 messages in period
Actual value of ended treatments	Sum total of actual value of 307 messages in period
Value never invoiced	Sum total of expected value of 301 messages at date, with 307 message but no 305 message (never started) + Sum total of expected value of 301 messages at date −/− Sum total of actual value of 307 messages (ended earlier)
Variation	Number of specialist treatment types; Number of neighbourhood team projects
Repeated requests for help	For all new 305 messages, verify if earlier a treatment was terminated
Reason of end of treatment	List of reasons for end of treatment, from 307 messages in period
Duration of treatment	Average umber of days between 305 message and 307 message
Waiting time	Average number of days between 301 message and 305 message
Percentage of 'opt-out' clients	Percentage of 315 messages with 'opt-out' condition

Table 3: Sample of key performance indicators, with suggested data sources. The 'opt-out' condition means that the municipality has no access to client records, but only to invoices.

3.5 Components

What needs to be implemented to get such a proposal to work?

- **Analytics Software**. To make the case study interviews realistic, a specific type of software was chosen to focus discussions about feasibility. 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). The reason to choose CAFI, is that several experts in the team have experience with both IDEA and CAFI. It turned out that CAFI can be interfaced with common software systems used at municipalities and care providers. However, none of the specific features of CAFI turned out to be crucial; so the result can be generalized to other continuous auditing software tools.
- **Control objectives**. For this pilot, we looked in particular at a kind of three-way-match. In accounting, a three match compares an invoice, with delivery, and the original order [44]. Because we are dealing with services here, it becomes a four-way match: before payment can be approved, the price, volume and type of care in the invoice needs to be verified against the service contract, and against data to show that the care was approved, and that the care was actually delivered. Another crucial test concerns residence verification: to be eligible for care, a client must be resident in the municipality. Finding such deviations early in the process, can save a lot of trouble later, of having to get expenses reimbursed from another municipality.
- **Dashboard**. Monitoring data is made available on a common dashboard, accessible by municipalities, care provider and, if necessary, the external accountant. Outcoems of test of controls can be shown. Budget depletion can be shown. Comparisons between care providers can be made. Automated warnings are generated in case specific financial figures don't match.
- **Data**. Relevant data is available for parties in the network. In particular, there is the Message Traffic infrastructure for exchanging data between municipalities, and care providers. According to the experts interviewed, that data is suitable to address the control objectives above. Table 3 shows a sample of key performance indicators that measure the four-way match objectives above, with corresponding data sources. However, even if data is technically available, not all data is legally accessible, to all parties. In particular, financial staff of municipalities and common arrangements may handle aggregated data and product codes, that testify that care was provided and was approved. They are not allowed to see the client dossiers behind these financial figures.
- **Governance**. Roles and responsibilities need to be defined, and agreement needs to be reached about how to deal with possible deviations. In particular, someone needs to decide whether a deviation counts as an exception, for which there is a plausible explanation, or a breach of the contract rules. These decisions must be archived [26].

This summarizes the main elements of a continuous monitoring application, to be implemented by the municipality (CM), with large involvement from the financial department. This would benefit the primary process of procurement and contract monitoring at municipalities. Also care providers could learn from their mistakes. In addition, we could imagine a parallel set-up, at the internal audit department (if present) and external accountant, based on the data in the dashboard (CA). This would create a shared understanding of the financial situation. Among the interviewees it was widely

believed that CM would be enough for the moment; an additional CA application would not add enough value. The general perception is that the problem lies in the reliability of the financial processes, not in the accounting aspects.

In comparison to this full-blown CA and CM proposal, we could also consider alternatives, which are less elaborate.

- **Process improvement**. Consider a financial monitoring system, without auditing jargon and complexities. This would help municipalities improve their processes and procedures, but it wouldn't provide any formal assurance.
- **Data analytics**. Similar data sets taken from Message Traffic could be analysed occasionally to identify bottlenecks and points for improvement. Such tests do not have to be repeated systematically at or near real time (not continuous). That would mean that municipalities could improve the processes, but after that, not continue to learn (learning cycle). More importantly, it doesn't offer the possibility to detect incidents immediately, and take action before an incident becomes a problem.

The fact that these alternatives make sense in principle, shows that continuous monitoring and auditing is essentially a modular concept. Some elements can be applied without the others: data analytics; process improvement and learning; continuous measurement, compare the discussion in [26].

3.6 Feasibility

First, is it technically feasible? This means in practice that the application landscape in a municipality offers enough opportunities for connecting a dashboard and filling it with meaningful data streams. In this research, we have looked at the requirements, in case a dashboard would be built with the CAFI tool, based on IDEA audit analytics software. It turns out that this software can be connected to the financial software packages that are often used in care providers and municipalities. So it would work for at least one plausible software system. However, there are many such software packages on the market. Nothing in our analysis crucially depends on CAFI functionality. All features appear to be generic.

Second, is the required data available? We have seen that the most important data for the financial process is technically available from the Message Traffic (Table 3). However, this is only meta-data (product codes); the underlying care-related personal data is not legally accessible. According to our analysis, access to personal care-related data is not needed for routine financial processes.

Third, is there enough support and expertise? This differs widely among the municipalities we have visited. Partly, IT maturity of the municipality depends on the size and location (city or rural), but not only. It also depends on historical developments and experience with other IT systems, and on the relative 'wealth' of the municipality, to have room for experiments and innovation.

Fourth, usually also economic feasibility should be discussed. Is there a business case for adoption of CA and CM? In our interviews, these questions were not discussed. The focus was on technical feasibility and support. Investments in software and employees with the required expertise, nor potential gains, in terms of efficiency and improved care, have not been estimated. This remains an important topic for future research

4 CONCLUSIONS

Continuous monitoring (CM) and continuous auditing (CA) are technologies with many potential benefits. Until now, most research on adoption of CM and CA has been conducted in the private sector, in the financial domain. In this paper, we have investigated the potential adoption of CM and CA techniques in the public sector, specifically for municipalities in The Netherlands. We conducted a multiple case study about potential adoption of CA and CM for monitoring spending on care related services in the so called'social domain'. We set out to answer the following research question: is it feasible to apply continuous monitoring or auditing in municipalities in the Netherlands, in order to improve reliability of financial reporting about the social domain?

The research indicates that application of continuous monitoring is indeed feasible at municipalities and common arrangements, and that there is a need for continuous monitoring in the social domain. Continuous auditing, in the sense of continuous data assurance under responsibility of an internal audit department or external auditor, is currently not needed, and is not considered to be feasible.

For the municipalities in our case studies, continuous monitoring technology is best applied in or close to the primary processes, where detected deviations can be followed up immediately, and process improvements can be made. Additionally, a one-off analysis can be made with data analytics tools, to detect possible deviations and opportunities for process improvement. So the general impression is that first the primary processes need to be improved, before it makes sense to invest further into continuous auditing, with a specific focus on financial reporting. CM and CA can be seen as a modular concept: not all elements have to be used at the same time.

However, there is an ambiguity in the terms CA and CM, that may also have played a role in our interviews. It is possible that respondents have understood the term 'auditing' to refer to accounting, whereas their immediate concern is with the quality of care. Seen from this angle, the focus on process improvement makes sense. This is also apparent in the motivation in Table 4: "Gain insight in care spending, so resources can be deployed where they are most needed.". As we discussed in Section 2, the term continuous auditing also refers to the specific aspect of continuous data assurance, i.e. applying data analytics. Seen from this angle, the rejection of CA is odd. As we have seen in the case, municipalities currently do have problems with the quality of data concerning the social domain. Data are incomplete, scattered among many parties, not up-to-date, or not in line with information needs. The current response of municipalities is to first improve the processes, so that quality of data will follow suit. However, process improvement also requires an analysis of where inaccuracies and mistakes originate from. This could be a strong benefit of CA. Further research is needed to find out if the preference of CM over CA is real, or only based on ambiguity of terminology.

The results of our research also indicate, that continuous monitoring in the public sector is feasible from a technological, legal and support perspective. Technologically, there are tools such as the CAFI tool or similar, that have the required functionality. The required data is in principle available from the Message Traffic standard. There are legal restrictions on availability of confidential

Name	GR-JR	Etten-Leur	Zaltbommel	Maasdriel
Size	Common arrangement (15 municipalities)	Medium sized	small	small
Location	Region in province of Zuid-Holland	Province Noord-Brabant	Province Gelderland	Province Gelderland
Procurement specialized care	by GR-JR	by Common Arrangement West-Brabant-West	by themselves	by Common Arrangement Rivierenland
Control approach care providers	Currently output-based, from 2018 outcome-based	Outcome-based	Trust partners to provide good care	Output based
Risk perception	Risk averse	Risk averse (double check invoices)	Risk-neutral	Risk averse
Budget Pressure	Some municipalities are over budget	within budget	within budget	Discount for youth aid, so expect less budget for 2018 and onwards
Monitoring Need	Need to closely monitor financial transactions	Need to closely monitor financial transactions (double spending)	No need to closely monitor financial transactions, but would like to monitor client satisfaction levels	Need to closely monitor financial transactions
Key performance indicators	Defined	Defined	Defined	Not defined
Feasibility	Could start continuous monitoring: technically possible, and enough support from municipalities	Could start continuous monitoring: technically possible, and enough data available from municipality and first line care	Could not start continuous monitoring: would first need to develop client satisfaction application	Could not start continuous monitoring, due to internal uncertainties. Planning bilateral collaboration. Policies might change

Table 4: Cross-case comparison (based on interviews)

data. In principle, care-related data items may not (always) be shared. These restrictions can in principle be overcome by using product codes, to indicate that care of a certain category was approved, and later provided, without revealing which specific care and to whom. Concerning support, it turns out that there are large differences in the readiness of municipalities to adopt CM. Some municipalities are ready; others are still busy to stabilize the processes and procedures related to the social domain.

Finally, the research indicates that the relative ease with which continuous monitoring can be applied depends to a large extend on strategic choices of municipalities, regarding the social domain. Some municipalities collaborate in a so called common arrangement, others join bilateral collaborations and some municipalities deal with the social domain individually. Interestingly, the one municipality in our sample which chose to deal with the social domain by individually (Zaltbommel), also uses another control approach towards care providers (based on trust) and therefore also needs other performance indicators (based on client satisfaction). Further research is needed to determine which kind of control approach is more effective and efficient in the long run. Compare the debate in management control [45].

Another factor that affects readiness is the relative wealth of a municipality and budget pressure. Municipalities with smaller reserves, or those which tend to be over budget, are forced to adopt a risk averse approach, and monitor care expenditures closely. Municipalities with larger reserves and less budgetary pressure have more space to experiment with different control approaches.

Given these results, many questions remain. More research is needed to investigate the effect of choices of municipalities on the effectiveness and efficiency of care provision. In general, more research is needed about adoption of CA and CM in non-financial domains. Given that CA and CM form a modular concept, comparative research is needed, in which CM and CA are compared to less elaborate alternatives, such as incidental process improvement or incidental usage of data analytics.

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