XBRL-Driven Business Process Improvement: A Simulation Study in the Accounting Domain

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Abstract. The eXtensible Business Reporting Language (XBRL) has been developed to standardize financial reporting. It could also improve internal business processes. Yet there is no scientific research to substantiate this claim. In this paper we use discrete-event simulation to determine the impact of XBRL on internal business processes. Simulation models of the existing and possible new situation are developed in a case study within the accounting domain. The redesigned processes are validated in a workshop. XBRL allows the merging of accounting and fiscal reporting processes resulting in a reduction of the duplication of activities and higher information quality. In particular, it is demonstrated that information quality, efficiency and lead-time can be improved by adoption of XBRL. In addition to technology-standardization on XBRL, data-standardization is a necessary precondition for realizing benefits.

Keywords: XBRL · Standardization · Accounting · Simulation

1 Introduction

Information Technology is recognized as an enabler for process improvement [3,6]. The eXtensible Business Reporting Language (XBRL) is a technology aimed at creating a standard representation format for exchanging financial information [28]. XBRL is an XML-based standard for internal and external reporting, including financial, statistical, taxation, and inspection reports. XBRL is a freely available international standard that enables gathering and dissemination of business information [9]. XBRL provides a standardized way to describe system-to-system information exchange. XBRL therefore enables a high level of semantic and syntactic interoperability [5].

Use of XBRL is claimed to lead to benefits like greater efficiency and improved accuracy and reliability in financial reporting [8]. However there is little empirical evidence that XBRL is indeed creating added value [1] and what the conditions are for accomplishing these benefits. Time savings, reduced effort, improved

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communication are mentioned frequently as possible benefits, but hardly any research to validate these claims could be recognized [25].

In the Netherlands, adoption of XBRL is embedded in the Standard Business Reporting program (SBR), which provides users with a unified meaning of financial concepts, such as income or revenue, made available in a taxonomy maintained by the Dutch government (http://www.sbr-nl.nl/english/). Although XBRL is originally developed for financial reporting to regulators it also offers opportunities for standardizing the internal business processes. Yet the actual adoption and usage of the standard is limited and many accounting firms are unsure how to adapt XBRL and specifically how to best apply XBRL in their own internal business processes to reap the benefits.

In this paper we report on a study of a simulation-based process improvement project at a medium-sized accounting firm in the Netherlands. A so called 'built-in' XBRL adoption strategy is modelled and simulated (see Sect. 2). In particular, we focus on the internal business processes for (i) compiling and submitting the annual financial statements of a client and (ii) preparing the tax returns for corporate income tax of a client. Both processes are affected by the adoption of XBRL. We conducted the following research activities. First we modelled the business processes in Business Process Model and Notation (BPMN) and analysed the existing software application landscape. We decided on definitions for measuring performance in this domain, such as duration and quality of outcomes. We then simulated the current processes in a discrete event simulation tool (ARENA). Based on literature, we identified opportunities for process improvement driven by XBRL and also simulated these expected process improvements. The outcomes of the modelling and simulation exercise were validated in a workshop with experts and end users.

The remainder of the paper is structured as follows. We start by explaining XBRL (Sect. 2) and by characterizing the accounting domain (Sect. 3). Thereafter we present the case background and simulation study (Sect. 4), followed by the relevant process improvements (Sect. 5) and the simulated studies (Sect. 6). The paper ends with a discussion and suggestions for future research (Sect. 7).

2 XBRL

The Extensible Business Reporting Language (XBRL) provides a foundation for the exchange of reports and data [9]. XBRL consists of four major components: XML standard, XBRL taxonomy, instance documents and XBRL specification. The actual data is represented in an instance document. Using link-bases, meaning is provided to this data by means of meta-data tags that refer to definitions from an official XBRL taxonomy. XBRL taxonomies for the accounting domain can have three categories: general-purpose financial reporting taxonomies (XBRL-FR), special purpose regulatory reporting taxonomies, and the general ledger taxonomy (XBRL-GL) [4]. XBRL is report oriented, but it enables to drill down to individual information items [17]. As XBRL is XML-based, instance documents are both human and machine-readable, and transferable between different software platforms. This means that once data has been

collected and labelled with meaningful XBRL-tags, it can be re-used for different reporting purposes. In the context of the SBR programme, this philosophy is called 'store once, report many' [5]. Official extensions to the basic Netherlands Taxonomy (NT) exist for accounting, for various fiscal reports, and for statistical reporting. These extensions are maintained by experts. A related application concerns credit applications by banks. Recently, there are developments to standardize meta-data concerning assurance over XBRL instances [16].

The working assumption is that XBRL adoption would produce efficiency gains [1,9,28]. Why? In principle, XBRL and SBR taxonomies can lower the costs of compliance, improve efficiency and improve information quality for the following reasons: (i) at the individual firm level, standardization and improved interoperability between software packages reduce the need to re-enter information, reduce processing time (remove superfluous controls), improve the audit-trail and improve information quality [5,25], (ii) for a community of users, this may lead to increased comparability, transparency and accuracy of reporting, improved systems flexibility and inter-operability, and ultimately improved market efficiency [5,25].

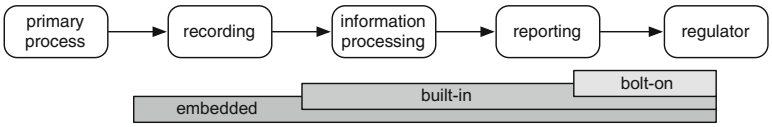

Fig. 1. Scope of XBRL adoption strategies: bolt-on, built-in and embedded [13]

These benefits are only potential. The way in which XBRL is utilized has an large impact on the benefits that can ultimately be achieved. Three different XBRL adoption strategies can be distinguished [13–15], illustrated in Fig. 1.

1. The *bolt-on* strategy only uses XBRL at the very end of the information processing chain. XBRL is not used within the client organization, but only for reporting to external regulators. One could argue that this will already produce some of the community benefits listed under (ii) above, but the process improvement impact on individual organizations is small: only the final PDF documents are being replaced by XBRL.
2. The *built-in* strategy integrates XBRL into the financial application landscape of both the client organization and its financial service providers, like accountants and tax consultants. This strategy requires adaptations to the software. Therefore it does involve a significant investment by clients and especially by the intermediaries. However, in the long run, this strategy is expected to reap most benefits.
3. The *embedded strategy* is most radical. Here XBRL is used for standardizing the way transactions are recorded in the primary process by the client, for instance into the general ledger. The version of XBRL that would allow such recording at the source is therefore called XBRL-GL. This makes it possible to

trace and verify transactions at the level of individual information items. We do see a purpose for this strategy, in particular in situations where assurance is required over specific limited subsets of data, such as credit reports for banks [16]. However, in the general case this vision would require a redesign of the core of ERP systems and financial software packages. This poses huge risks to the continuity and reliability of financial reporting. Currently, financial software vendors are reluctant to enter this market. They have often built their business models around a proprietary data representation standard.

3 Accounting Domain

In the following paragraphs we characterize the accounting domain by means of general observations: O1, O2, etc. These observations will be used in Sect. 3 to evaluate the feasibility of possible process improvements.

Accounting is the process of recording financial information about a business entity, analysing that information, and reporting the results to stakeholders, such as management, shareholders, creditors, and regulators [20]. Accountants must provide some form of assurance that the reported financial information is correct, complete and timely. The activities of an accountant are therefore subject to intensive regulation and professional standards. This means that the people in accounting firms are traditionally more focused on *information quality* and *compliance*, rather than on operational efficiency (O1). Please note that in our case study, we looked at the process for compilation of financial statements, for relatively small clients, which strictly speaking does not involve assurance. Therefore it is not as heavily regulated as the official accounting processes. However, like all processes, also these are subject to professional standards of conduct.

Many process improvement techniques have been pioneered in manufacturing [27]. An important difference between manufacturing and accounting, is the intangibility of services compared to the tangibility of products. Intangible products are known to be people intensive in production and delivery [21]. This makes for *large lead times* and explains the importance of *planning and control* (O2).

Intangible products typically are information intensive [22]: they require large amounts of data. Accounting is no exception. Moreover, decisions require knowledge and professional expertise, for example about business risks in different sectors, or about financial standards and regulations. Therefore specialized and trained professionals must execute the business processes. Accounting is a *knowledge-intensive* domain (O3).

We also find a high degree of *customization to clients* (O3), a characteristic that is specific to all services [30]. Accounting firms tend to serve a large variety of clients, each demanding different solutions for the financial issues they face. Fahy et al. [12] state "although there are reasonably homogeneous participants in the financial information supply chain, the clients demand a high degree of data customization" (p. 128). Because of client specificity, much time and effort is required for professionals to understand a new client. The dominant business

model for accounting, is based on billable hours. So the time needed to understand a client is paid for by themselves. For these reasons, clients will not easily switch accountants.

Accounting firms can be characterized as a professional bureaucracy [24]. They typically have a decentralized structure. Usually, there is a head office with staff departments, such as an IT department and a professional standards office. The real power resides with individual departments, headed by a managing partner. Innovations are dependent on support from the managing partners; they need to be convinced. XBRL adoption requires IT adaptations and standardization of processes, which may trigger resistance. The decentralized structure, often grown during a series of mergers and acquisitions, has also resulted in a highly *complex application landscape* (O5). Adoption of XBRL, especially in the beginning of the information processing chain (built-in or embedded strategy), is likely to reduce the complexity of the application landscape.

Given the specialized nature of their tasks, employees rarely collaborate across department boundaries, even when that would be beneficial to the client. As we argued above, being a standardization effort XBRL is supposed to improve *information sharing* (O6), both internally between separate departments (e.g. between tax and accounting) and externally with regulators and government agencies.

4 Case

A medium sized accounting firm in the Netherlands, hereafter called BCD, was studied. The firm deals mostly with small and medium sized enterprises as clients. Like most accounting firms, the organizational structure of BCD reflects the most important activities: assurance, tax advisory, and various consultancy services. Although there is a centralized head office with support staff, individual departments are free to choose how to conduct their business. Traditionally assurance and tax advisory are separated.

The case study focuses on improvements to two processes performed for clients: the process for compiling and submitting the annual financial statements (FS), and the process for preparing the tax returns for corporate income tax (TR). Both processes are affected by the adoption of XBRL. The Standard Business Reporting (SBR) program of the Dutch Government provides an official taxonomy containing the meanings of financial concepts. In particular, the taxonomy has harmonized the fiscal and accounting perspectives on concepts like income or revenue. According to the Harmonization Act of 2008, small entities are allowed to compile their annual financial statement based on fiscal grounds (Dutch: Wet Samenval). Large parts of the TR process can therefore be based on results of the FS process. This opportunity triggered BCD to start a project to re-design their internal processes and application landscape around XBRL. Our research was done in the context of this project. For more background see also [19].

Data about the processes was collected by interviews with our informants, by document reviews, and by data obtained from the central 'hour registration files'

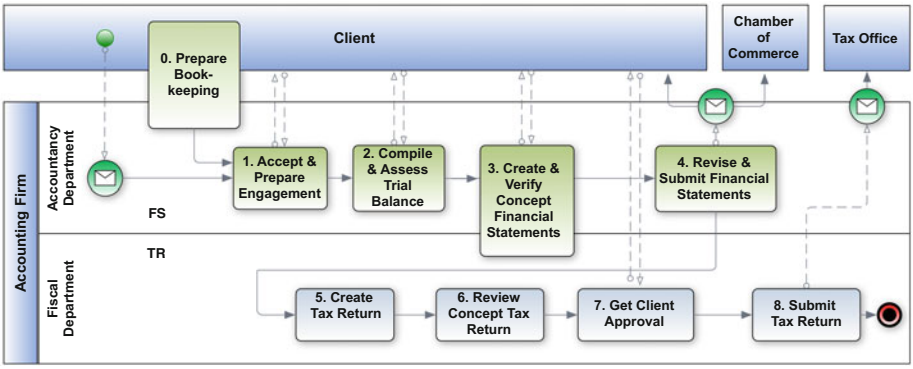

Fig. 2. Simplified process overview for compilation of annual financial statements (FS), and preparation of tax returns for corporate income tax (TR)

of BCD, where all billable and non-billable hours for employees are recorded. Our informants are members of the XBRL project management team, located within the centralized staff department. The validation workshop was carried out with experts and end users from various sub-departments and offices.

A simplified BPMN model of the FS and TR processes is shown in Fig. 2. A more detailed overview can be found in [19]. Interaction with the client and external stakeholders (chamber of commerce for filing annual financial statements, tax office for tax returns) is shown at the top. The accountancy department handles the FS process (upper swim lane) and tax specialists handle the TR process (lower swim lane).

Suppose a client has entered into an engagement with an accounting firm. In principal, a client performs its own bookkeeping, with some assistance by the accountant (task 0). The administration is transferred to the accounting firm, who must decide whether the quality is good enough to accept it, and prepare the activities involved in the engagement (task 1). The next step is the compilation of a trial balance on the basis of the data being provided and an assessment of the accuracy of the data (task 2). Each of these steps requires consultation with the client, indicated by dashed lines. In task 3 the accounting firm then creates a concept financial statement, and verifies it by consulting the client. Based on these checks the concept statement is revised, finalized by the client and submitted to the Chamber of Commerce (task 4). That concludes the FS process. Similar steps are followed for the TR process: task 5 creates a concept tax return, which is being reviewed (task 6) and approved by the client (task 7), after which the tax return is submitted to the tax office (task 8).

Next an overview was made of the software application landscape and how the different process steps are supported. The result is schematically shown in Fig. 3. Numbers refer to the steps in Fig. 2. The BPMN and software application landscape models were validated with our informants. As you can see, the

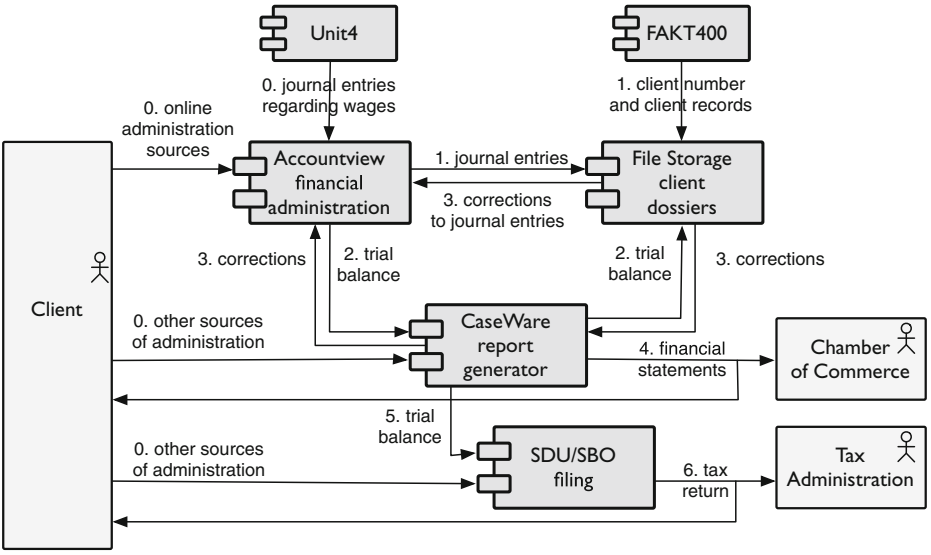

Fig. 3. Schematic software application landscape supporting the FS and TR processes

application landscape does contain redundancies. Some functionality is offered by several applications.

On the basis of the process model a simulation model was made of the FS process. A screen shot of the animation of the simulation model is shown in Fig. 4. The simulation model is more detailed than the process in Fig. 2. The different phases of the process are indicated as columns: planning and preparation, execution, verifying concept, client validation and approval, finalizing. Below you can see the subtasks for the different roles: accountants (yellow), distinguishing the assistant accountant, the engagement leader and the responsible accountant, client (green), secretary (orange), fiscal experts (dark orange), distinguishing responsible and assistant fiscal experts. Note that activities related to the client often involve waiting.

The structure of the simulation model was validated beforehand with process experts. The simulation model was tested by feeding it realistic input data and comparing the outcomes with actual data. In general, simulation studies depend on the quality of input data. It turned out that the accounting firm's hour registration that served as input data, was much less reliable than was initially believed. For instance, there are differences in the way separate departments record data, and therefore data turned out to be incomparable. Some categories of activities are not separately recorded. For instance, time spend on corrections was not recorded separately, so we could not quantitatively assess the impact of process improvements on quality. We could however make a qualitative assessment, as we expect that the number of corrections was reduced.

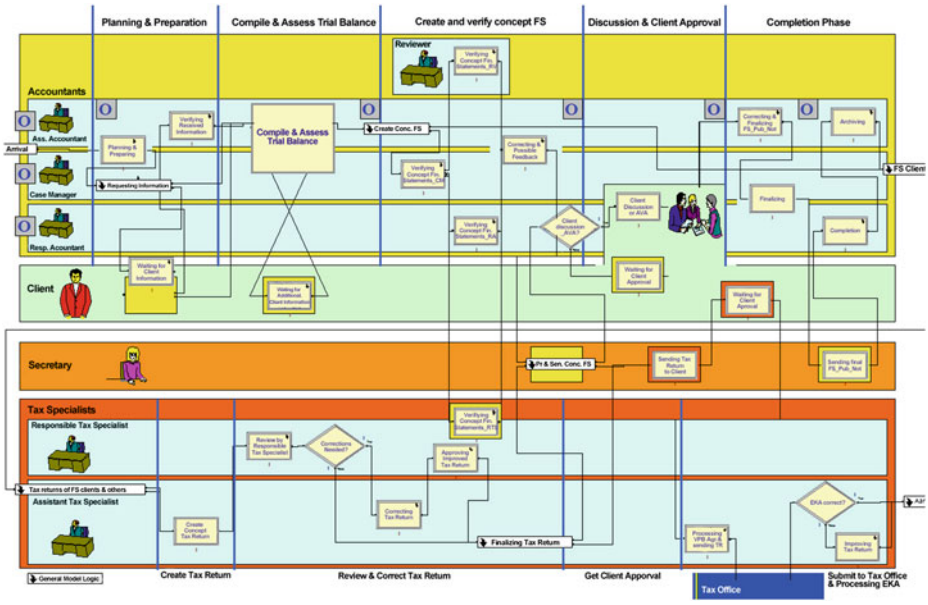

Fig. 4. Screenshot of the animation of the simulation model, to give an impression (Colour figure online)

How should can the effect of the proposed interventions be measured? Concerning input into the process, the most important resource is *human labour*, measured in hours spent by employees. Through their salaries, this is directly related to the costs. The organizational role of the employee is also noted. This information was obtained from the centralized hour registration. A natural unit of work is a client dossier. Information itself is not modelled as a separate resource in this type of process-based simulation.

Concerning output we decided that *lead-time* (in days), and *customer satisfaction* (on a 1 – 5 scale) are the most important variables. In addition, we also considered measures of *quality*, as this is essential in the accounting domain. However, it is hard to find a good measure of information quality. One could say that quality is inversely proportional to the number of errors per dossier. But what counts as an error in this case? Errors are professionally unacceptable: work must comply with accounting standards and procedures. We decided to approximate output quality by the number of additional corrections that were needed to complete a dossier. Compare [11] who use corrections to approximate deficiencies in internal control. Unfortunately, time spent on corrections and adjustments is not separately recorded in the hour registration. Therefore this quality variable turned out to be intractable.

We studied the empirical data collected from the hour registrations to find trends and correlations before starting the simulation studies.

An important variable is client complexity, as a more complex client structure due to subsidiaries, mergers and acquisitions usually takes longer to process. On the basis of the data, it turned out that the number of subsidiaries (i.e. number of dossiers per client) and number of general ledger accounts (GLA) can be used as approximation of client complexity. These predict the amount of work. Linear regression produced the following formula, with 50 % explained variance and $Sig. < 0,01$.

$$Hours = 51 + 28 * Numberof Dossiers + 4,9 * Average\ GLA.$$

We also looked at the role of the case manager (Principle 4d below). The opposed suggestion is to 'empower' employees by giving them more responsibility (Principle 5c). We compared offices with and without a relatively large involvement of a case manager. No significant difference was found. We did find that offices with large involvement of a case manager used less assistant accountants per case, either because the case manager works more productively, or because the work is better managed. Since the case manager earns more, there is no difference in the use of resources.

5 Process Improvements

There has been a lot of research on process improvements. We mention Business Process Reengineering, e.g. [18], which suggests radical changes, often based on new business models or on clever use of IT. There are also continuous improvements schemes like Lean [7], which tries to identify and reduce 'wastage', those activities that do not add value for the customer, Six Sigma, e.g. [2], which tries to improve predictability of the process, and the Theory of Constraints, e.g. [10], which tries to remove or reduce the impact of bottlenecks. These approaches have been widely discussed in the literature. Therefore we take an existing overview by Reijers and Mansar [27], who have formulated best practices specifically for improving administrative processes.

The principles in Table 1 are mostly based on the best practices of Reijers and Mansar [27] and are also clustered according to the categorization they use. We did not use practices in their category 'Products', as the accounting domain is based on services. We didn't use their category 'External Environment' either, because that is about trusted third parties and outsourcing, which do not apply here.

In our case study, we identified those process improvement principles which made sense in the accounting domain, and which are facilitated or related to the possibilities offered by the adoption of XBRL. In particular, we looked at the characteristics of the accounting domain studied in Sect. 2. We use the following notation: a '+' in Table 1 means that the principle applies because of the specified domain characteristic, and a '–' that the principle is disqualified by the characteristic. Thereafter the usefulness of the principles was evaluated by actually applying them to the BPMN process models.

Table 1. Impact of domain characteristics on recommended process improvements, based on [27]

Clusters		Improvement principles	Quality and compliance (O1)	Planning an control (O2)	Knowledge intensive (O3)	Customization (04)	Application landscape (O5)	Information sharing (O6)
1. Customers	a.	Control relocation: move control to the customer	+	+			+	+
	b.	Contact reduction: reduce the number of points of contact with customer		+				
	c.	Integration: integrate system and processes with customer systems and processes	+	+		–	+	+
2. Operation view	a.	Task elimination: eliminate unnecessary tasks ('wastage')	–				+	+
	b.	Triage: divide a general task into two or more alternative tasks, or combine several alternative tasks into a more general task		–	–	–	+	
	c.	Task composition: combine small tasks into larger composite tasks and divide large tasks into workable smaller tasks		–	–	–	+	
3. Behavioural view	a.	Parallelism: execute independent tasks in parallel, if possible		–			+	+
	b.	Exception: optimize business processes for the normal flow and fork-off exceptions to specialists				+	+	
4. Organization: structure	a.	Order assignment: let workers perform as many steps as possible for a single order			+	+		
	b.	Customer teams: assign specific persons or teams to specific customers			+	+		
	c.	Numerical Involvement: minimise the number of departments, groups and persons involved	–		+	+	+	
	d.	Case manager: make one person (case manager) responsible for handling each type of order	+	+	+	+		
5. Organization: population	a.	Specialist generalist (tasks): distinguish specialists and generalists for specific tasks			–	–		
	b.	Specialist generalist (domains): distinguish specialists and generalists for customer domains			+	+		
	c.	Empower: give people more decision rights and reduce middle management	–	–	+	+		
6. Information	a.	Control addition: check completeness and correctness of input before processing, and check output before it is sent to customers	+		–	–	+	+
	b.	Buffering (batch): instead of immediately asking for information, buffer requests		+				
7. Technology	a.	Task automation: replace manual tasks by automated tasks	+		–	–	+	+
	b.	Integrated technology: avoid constraints in the process by using integrated technology	+				+	+

Cluster 1. *Customers.* The first improvement principles refer to the customer. Re-allocation of controls to the customer may improve data quality. Data quality drives many other improvements [26]. When potential errors are caught early in the process, this will reduce repeated correction efforts later. In particular, we tested the principle to only start working on a dossier when it is known that all data is present. Incomplete dossiers lead to additional work, collecting, asking and verifying the missing data. Further benefits are expected from reducing the number of interactions with the client, and in general by better integration with the client's processes and systems. Note that XBRL standards make such systems integration relatively more feasible, as it facilitates software interoperability.

Cluster 2. *Operation view.* These principles refer to the design of the business process. Redundant tasks may be eliminated. In the Lean philosophy, tasks that do not directly add value for the customer are called 'wastage' [7]. Typical cases of wastage in this case are the numerous quality controls. Triage refers to the practice of identifying tasks into a specific categories, which must be handled in a specific way, e.g. by specialists. Composition refers to the practice of clustering tasks into larger units which need not be handled by a specific resource (person). The merging of FS and TR processes is an instance of composition.

Cluster 3. *Behavioural view.* The following principles are about choices made during execution of a business process. When possible, tasks should be executed in parallel. Because of the harmonization of fiscal and accounting concepts, some of the FR and TR processes can now be executed in parallel, on the basis of the same financial data ('store once, report many'). Task 4 can for example be done in parallel to task 5, 6 and 7, which are independent. The Exception principle refers to the practice of optimizing a business process for the most common flow, and fork off exceptions that require special treatment. This does make sense in the accounting domain, because of the large client variability, although it is hard to find a flow which is common to a majority of cases. In fact, deciding on these exceptions is part of the task of the case manager (see below).

Cluster 4. *Organization: structure.* These principles affect the way the work is being organized. Order assignment means that a case is preferably allocated to a single person, who has already worked on the same case before. This is common practice in accounting. Eventually, this practice leads to specialized customer teams. This corresponds to Observation 4. Numerical involvement seeks to minimize the number of departments, groups or persons involved in a single business process in order to reduce coordination overhead. However, accountants value segregation of duties to ensure quality control. According to this principle, no single person may both execute and approve a major decision. A case manager is appointed to manage all tasks related to a specific engagement. The converse idea of removing case managers to stimulate self-steering teams, is also tested in the simulation. We expect it will not lead to improvements, because case managers also have much experience about the content of the various engagements.

Cluster 5. *Organization: population.* This cluster is about resource allocation. An important principle is to distinguish specialists and generalists and only assign specific tasks to specialists. This frees up (expensive) specialist resources

and also reduces waiting for a specific resource. In the case study we see a move towards generalists, especially now that FR and TR are harmonized. There is no longer a need for specific fiscal or accounting expertise. However, it does make sense to specialize in specific customer domains (e.g. healthcare; construction; financial services; manufacturing, etc.). In fact this is already the case, as is reflected by the names of the departments and the existence of customer teams. Empower refers to the practice of giving employees more decision rights and the ability to organize their own work. This should reduce the need for middle management, which strictly speaking does not add value. However, in the accounting domain, the partner (responsible accountant) must supervise quality of the work (Observation 1). We expect the partner to be a bottleneck. That would suggest planning the process to optimize their utilization, for instance, by adding a planner.

Cluster 6. *Information.* Control addition tries to improve information quality, by verifying outgoing materials to reduce potential complaints, and by checking the completeness and correctness of incoming materials, before processing. This makes a lot of sense as incomplete or sloppy client evidence is a well-known source of delays in the accounting domain. BCD does in fact try to convince clients to take responsibility for the quality of data, partly by price incentives. Clients who have a reliable bookkeeping system that can be easily interfaced with BCDs systems pay reduced fees. In this case, buffering means that instead of always requesting information from clients when needed (by telephone) it is better to cluster such requests and handle them all in one go. This reduces fragmentation of efforts and thereby also improves information quality.

Cluster 7. *Technology.* Task automation clearly makes sense for the data collection and processing steps, as manual errors can be avoided, especially since most data is already available electronically. Integrated technology is required to improve interoperability. Witness the overlaps between functionalities of applications in Fig. 2. This is one of the expected benefits of XBRL standardization.

6 Simulation Studies and Evaluation

The principles in Table 1 are generic. They must be translated into specific adjustments to the processes underlying Fig. 2. Each of these adjustments corresponds to a kind of hypothesis to be tested. However, some adaptations depend on each other; they cannot be tested independently. Therefore it makes sense to cluster these adaptations in the simulation experiments. Many adjustments could not be meaningfully implemented in the simulation model, for various reasons: lack of data, limitations of the software or of the analyst. Of the list of 35 adjustments proposed by Kloos [19], we will now discuss those that could be implemented and tested.

- As-Is: The situation as sketched in Fig. 2, before merging FS and TR.
- VII: Assign the most specialized resources (available) to the corresponding tasks.

Table 2. Lead time changes as a result of simulation experiments; resources are kept constant

Variable	As-Is	VII, IVa		XI		I		V, XIX		IX		XXI	
Lead time concept FS	52,5	58,1	10,8 %	58,3	11,1	54,3	3,5 %	41,5	−20, 9 %	72,6	38,4 %	47,8	−8, 9 %
Lead time FS	63,0	70,5	11,8 %	70,	12,1 %	71,4	13,2 %	55,3	−12, 3 %	80,9	28,4 %	58,6	−7, 1 %
Lead time both	64,8	58,2	−10, 3 %	75,5	16,4 %	82,6	27,4 %	62,0	−4, 4 %	82,4	27,01 %	64,1	−1, 2 %
Lead time concept TR	3,9	6,6	69,3 %	3,6	−7, 9 %	4,0	3,4 %	3,9	−0, 1 %	3,8	−0, 98 %	4,1	5,0 %

IVa: Combine discussing with the client for the concept tax return with discussing the concept financial statements. These adjustments are already part of the running improvement project, which is why they are combined in the experiments.

- XI: Let the review of the tax position by the tax specialist be either performed by someone of the accountancy department or eliminate this review.
- I: Relocate checking completeness and accuracy of input data towards the customer.
- V: Prevent having to request additional or missing data.
  XIX: Always perform an intensive check on the input data.
- IX: Combine various planning and preparation tasks into one composite task.
- XXI: Collect input data from the customer on a more frequent basis.

First, the adapted processes were implemented and a series of simulation experiments were executed to test the influence of the adaptations on the only two performance measures that were tractable: lead-time and use of resources.

Second, we invited an expert panel consisting of 7 employees with different function levels (assistant accountant, case manager, responsible accountant) from different disciplines (tax and fiscal). Participants filled in an individual questionnaire. After that, we showed the process model and the simulation model, and discussed the expected influence of recommended process improvements on the performance indicators. According to the panel the expected benefits from the principles could be confirmed [19].

The simulation experiments display observable effects. These outcomes were later confirmed by the experts in the individual questionnaires and discussion session.

- *Decrease in lead time*: by having less process steps, less corrections, more parallel execution, less specialists and therefore less waiting time, the total lead time decreases. In particular the integration of FS and TR (VII, IVa) decreases total lead-time by 10 % (approximately 6 days). However, it increases the lead-time of FS. The decrease in total lead-time is less than originally expected by business experts. However, currently there is a large waiting time between the two processes, which was not modelled in the simulation. This explains the expectation gap.

The simulation model also shows a decrease in lead-time, when processing only starts after the required information is known to be complete. A 20 % decrease in the time needed before sending a concept version to the client is found for improvements V and XIX, and a decrease of 12 % for the time to complete a financial statement. For improvement XXI, collecting data more frequently, these reductions are respectively 9 % and 7 %.

- *Improved efficiency*: by avoiding data re-entry, reduction of control activities, and better deployment of people (mixed specialist teams; case manager) more work can be done with the same resources, while also maintaining the same quality level.

  However, the simulation model lacks some predictive capability. For improvement XI (remove the separate tax review) we found an increase in lead-time of 11 %, while this is not logical. For improvement IX (combine tasks within the planning and preparation phase) an increase of 30–40 % (20 days) was found. Therefore, the simulation model is falsified regarding the effects of elimination (or combination) of tasks; apparently this changes the structure of the simulation model to such an extent that it leads to significantly different results.

In addition, there are a number of XBRL-related benefits that could not be quantitatively studied or simulated, but they could be qualitatively confirmed by the expert panel.

- *Improved data quality*: as data is not re-entered any more, and data definitions have been standardized, data quality is improved, which is itself a driver for other process benefits (less corrections; less customer contacts).
- *Improved assurance*: due to an increase of the data quality, the assurance level of the services might be improved too, although this depends on the business model. This is crucial in the domain (Observation 1)
- *Customer satisfaction*: although this is not easy to measure, experts expect that customer satisfaction will increase due to the overall higher quality of services (faster response times; less effort; less corrections). They thought that on the short term the use of XBRL could create an important competitive advantage.
- *Agility*: XBRL standardization enables reuse of data and aids configurability of systems. This makes it easier to create new business processes and adapt existing processes to new regulations.
- *Maintainability*: in the long run, the reduced complexity of the application landscape will make the software cheaper and easier to maintain.

In the expert validation session, we asked participants to cluster sets of related process improvements, resulting in four relatively independent categories that are meaningful for both experts and users. In the following description, the tasks refer to Fig. 2; individual numbers refer to the principles of Reijers and Mansar in Table 1.

- Category 1. *Rely on the customer* (task 0 and 1): improve data quality of the dossiers being provided by the client, by using XBRL-based software and

improved software interoperability (7b), and by making the client responsible for the quality of the bookkeeping, possibly by price incentives (1).
- Category 2. *Merge the FR and TR process* (task 4 and 5, 6, 7), as much as possible, using the opportunities of XBRL standardization and SBR harmonization (2b,c). This leads to less dependencies, better utilization of resources, more parallel execution and less specialists to wait for (3a)(5ab).
- Category 3. *Remove quality controls* (2a), especially for smaller clients, by giving assistant accountants more responsibility (5b) and by building reconciliation checks into the software (task 3, 4, 6, 7a). XBRL makes these automated controls easier to set up and maintain.
- Category 4. *Simplify the application landscape.* Use only a few multi-purpose software applications instead of many traditional single-purpose applications, in order to reduce the complexity of the application landscape (Fig. 3) and avoid re-keying of crucial data (7b).

These alterations will have a large impact. Category 1 and 2 affect the way the accounting firm makes money from its services. Category 1 could involve a reduction in fees for customers with a reliable bookkeeping. Category 2 means that compilation services and tax advice are no longer offered as separate services. Likely the efficiency gains will be relatively more visible in a business model based on subscription, where the customer pays a fixed fee, than in the current business model based on billable hours. After all, efficiency gains reduce the number of billable hours. However, there was consensus among the experts that customers of accountancy firms are increasingly critical and demand more value for money, partly due to the credit crisis. They are no longer willing to pay for re-keying the information they provide electronically. Future research can look into the effect of business models on process improvements.

7 Related Research and Research Limitations

Alles et al. [1] provide an overview of research about XBRL adoption. They note that till now, most XBRL research has been technology-driven, and that proper empirical validation has been lacking. In particular, they call for a better analysis of the nature and benefits of XBRL adoption, and for field-based studies.

Concerning principles for process improvement, there has been a lot of research. Increasingly this also extends to the domain of administrative services [7,27], of which accounting services are only a part. Accounting is somewhat special in the sense that it concerns a highly regulated domain. Therefore, traditionally accountants have focused on compliance and information quality, rather than operational efficiency. In further research, it would be interesting to compare our findings with process improvements for other legal professions, such as notaries and lawyers. Note however that the mortgage industry, which is also about financial services, did in fact make a huge transition as the result of the adoption of inter-organizational systems and standards [23].

Not all simulation experiments were successful. Some adjustments concerning the elimination or combination of tasks show counter intuitive results. Moreover,

the research is limited in scope. We studied a single case, which concerns a medium sized accounting firm and two internal processes targeting SMEs, so we can only draw limited conclusions. In particular, in future research we would like to look at larger accounting firms and we would like to investigate the auditing processes themselves, to find more empirical evidence of internal benefits of XBRL related to assurance, beyond interoperability and reporting functionality.

8 Conclusions

XBRL is a representation standard for information exchange, which is hailed for bringing many benefits. Yet there is little empirical evidence that XBRL creates these benefits and how they can be accomplished. In this paper we analysed the possibilities and implications of XBRL for improving the internal business processes of an accounting firm by simulating the effects of improvements. The XBRL-based improvements can be clustered into four main improvement categories: 1. Rely on the customer, 2. Merging the financial reporting and the tax reporting streams of the process, made possible by the semantic harmonisation of the financial and fiscal concepts, 3. Reducing unnecessary controls, and 4. Simplifying the complex application landscape. The benefit originates mostly from not having to re-enter information and from the standardization effects. XBRL shows precisely which data fields are mapped onto each other. This results in higher data quality, integrated processes, and efficiency. A decrease in lead-time was directly observable in the simulation studies.

In addition, benefits mentioned by the experts include improved data quality, improved assurance, increased customer satisfaction, increased agility and maintainability. The standardization of information exchange is a necessarily pre-condition for obtaining many of these advantages. The XBRL standard itself creates technological interoperability; this will facilitate a simplified application landscape. The data standardization of the SBR program creates semantic interoperability: shared meanings of financial concepts. The latter facilitates advantages like reduction of the number of manual controls and faster lead-time. An example is the harmonization of the fiscal and accounting concepts of income. Therefore, teams can be merged and resources are better allocated as there no need to wait for either fiscal or accounting specialists.

In this case study a built-in strategy towards XBRL adoption was followed, resulting in the before mentioned benefits. A more radical approach is the embedded strategy, which might result in more long-term benefits related to standardization and improved data quality. However, because the embedded strategy would require a redesign of the core of financial packages, with clear implications for the reliability of financial reporting, this approach is much more risky. We recommend more research in the different XBRL adoption strategies and the benefits that can be accomplished. In a sense, the XBRL standard with the taxonomies, their users and the various governance structures, can best be seen as a kind of information infrastructure, compare [29]. An infrastructure enables all kinds of improvement, but it requires users to apply it. Such an infrastructure may also provide opportunities for offering new services. Therefore more

research is needed to test new business models for the accounting domain, based on improved interoperability and standardization, rather than billable hours.

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