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Accounting Information Systems: The Challenge of the Real-Time Reporting

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Abstract

Real-time reporting in accounting or simply real-time accounting offers many benefits when compared to conventional periodic reporting. Traditionally, enterprises require financial or non-financial reporting based on quarterly and annual periods. Yet, the rapid change that occurs on market and society causes this periodic reporting to become quickly outdated. Higher competition among enterprises demands for more updated information to enable management to rapidly adapt to opportunities and answer problems. Real-time accounting addresses these needs, but needs new technological answers. In this article we present some technologies which can help the implementation of real-time accounting, namely, business process management, mobile devices, cloud computing, business intelligence, enterprise architecture and enterprise application integration.

Keywords: management information systems; accounting information systems; real-time reporting; real-time accounting.

1. Introduction

The running stream of fast changing, increasingly competitive global market and rapidly shortening product life cycles forces enterprises to analyse accurate and timely information, in order to react instantaneously to changes in

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its business [1, 2]. Enterprises are entering a new era, the era of the real-time enterprises and real-time economy also called the "now economy", which can be characterized by a substantive acceleration of business measurement, assessment and decision processes [2]. The now economy poses a new challenge to Accounting Information Systems, which is the real-time reporting.

Real-time reporting in accounting or simply real-time accounting offers many benefits when compared to conventional periodic reporting [3]. Traditionally, companies require financial or non-financial reporting based on quarterly and annual periods. Yet, the rapid changes occurred on market and society cause that this periodic reporting to become quickly outdated. Higher competition among enterprises demands more updated information to allow management to rapidly adapt to opportunities and answer to problems. Professional investors believe that real-time reporting from enterprises allows them not only to better understand corporate performance but also to be more confident on corporate governance, which increases the likelihood of those enterprises to attract more investment from institutions [4]. The move towards real-time reporting from the simply publishing of financial statements every three, six or 12 months is therefore almost mandatory and accounting and Accounting Information Systems (AIS) must answer to this new demand through the use of new technologies.

There are several complementary technologies available to help implement real-time reporting like business process management, which allows real-time monitoring of business processes that broadcast relevant financial or non-financial information from business operations to management; mobile devices which allows its users to instantly receive the reports produced anytime and anywhere; cloud computing that allows the instantly sharing of information among all users within and outside the organization that need it to make informed decisions; business intelligence, which allows the generation and delivering of more focused and relevant information of business operations to managers enabling not only the long term planning of the organization goals but also the management and optimization of daily business operations (event-driven); and enterprise architecture and enterprise application integration that structures and integrates different systems and their corresponding data present in the organization to allow real-time report generation with added value to users.

The paper presents a reflection, based on existing literature review and market Information Technologies/Information Systems (IT/IS) players, some future technological answers to real-time reporting in the accounting domain, be it financial or managerial. This paper is organized as follows. The second section presents a literature review on reporting, starting in the traditional view of reporting and ending in the real-time reporting. The third section focuses on real-time reporting and the challenges facing its implementation. The fourth section presents the foreseen technological answers to real-time reporting. Conclusion and future work are presented in the final section.

2. Reporting under the accounting domain

The main purpose of accounting is to provide information that is needed for sound economic decision making be it of financial nature or of a managerial one for internal, but also for external decision making. Accounting has been defined as the process of identifying, measuring, recording and communicating economic information to permit informed judgments and economic decisions [5], in one word "Reporting". According to Oxford Dictionaries, "report" is a verb that came from Latin word "*reportare*" which means "bring back", as it results from the junction of two words: "re", meaning "back" with "*portare*" meaning "carry". By the middle of the 19th century, the sense "give an account" gave rise to another sense of this verb, which is "submit a formal report". So, generally speaking, "report" means to "give a spoken or written account of something that one has observed, heard, done, or investigated" [6]. Of course, "reporting" can fit into various different contexts, like financial reporting, journalism, court reporting, traffic reporting and operational reporting.

When we think about accounting functions, we are mainly thinking about a systematic and comprehensive recording of financial transactions which are important to the business. They also refer to the process of summarizing, analysing and reporting these transactions. Innumerous financial transactions comprising a certain period are considered to process a statement that summarizes a company's operations, financial position or its cash flows [7]. So, accounting reporting is traditionally the provision of relevant information covering quarterly and annual periods which supports subsequent financial decisions. Likewise, the accounting information is usually presented to other stakeholders, like potential investors, creditors, suppliers and customers [3].

2.1. Information dimensions for reporting

Reporting under the common term of "accounting" has multifaceted perspectives and it is not limited to financial domain. It may be simply viewed through three dimensions. It may have financial or non-financial data, it may be mandated or voluntary and it may be of quantitative or qualitative type [8]. Fig. 1 represents the information dimensions of reporting under the accounting domain as being made up of quantitative/qualitative, financial/non-financial and mandated/voluntary disclosures [8].
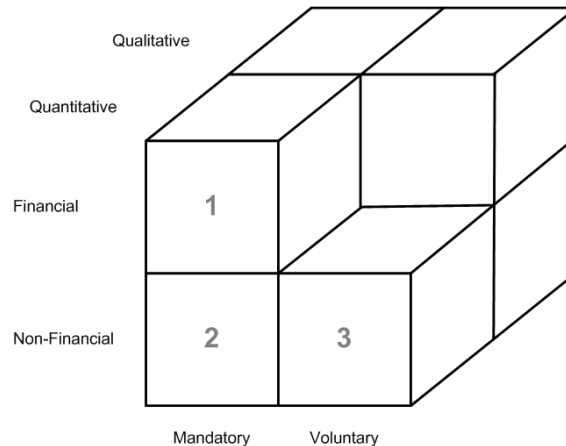

Fig. 1. Information dimensions for business reporting. Adapted from Lymer et al. (1999)

Accounting reports may comprise significant different perspectives like accounting operations (transaction processing, accounts payable and receivable, internal financial reporting), external reporting (statutory reporting, corporate finance, treasury and financial risk, and regulation, including internal audits, compliance with regulatory requirements and taxes), management accounting (forecasting, budgeting, costing and reporting on variances like cost control or detailed reports about performance against budget, as well as cash flow management), the management support (like identifying and analysing strategic options, decision support, designing and tracking key personnel indicators, benchmarking, strategic management accounting, and business risk management), the staff management, training, scrutiny of capital projects, emphasis on customers and products, reports about debtor and creditor ageing, auditing, internal controls implementation, risk management, error or fraud detection, accountability, among others [9-16]. Reporting is probably the most frequently performed activity by accountants [12, 17, 18] and one the most important features of an Accounting Information Systems (AIS), not always well-covered by Enterprise Resource Planning (ERP) systems [19] that some accounting professionals considerer as the AIS. This is also evidenced by the innumerous times (357 times) that the word "reporting" appears in the Accounting Information Systems book of James Hall [12, 20].

2.2. The now economy and its impact on accounting reporting

In 2002 both the Economist and The McKinsey Quarterly Newsletter talked about the idea of the now or real-time economy where companies interact in real-time supported by a complex set of enterprise software products and services that could transform the way companies work creating the concept of real-time enterprises. This new business model needs a new business accounting, real-time accounting. In short, while businesses are moving on to the "now" economy, accounting remains in a "traditional" mode [2].

During years and years, accounting reports were based on quarterly or annual periods. The management of enterprises used that periodic reporting to make their decisions. However, market under a huge competition context and society change more and more rapidly which causes that this conservative periodic reporting to become quickly

outdated. This gap between the paradigms driving business and accounting leads enterprises to ask themselves about the value of having (non-predictive) financial statements and feel the necessity to enter into a new accounting paradigm regarding reporting, called real-time reporting. Real-time reporting on accounting (or just real-time accounting) allows management to rapidly adapt to opportunities and answer problems [3].

The Association of Chartered Certified Accountants (ACCA) recently published a research study called "Understanding investors: the road to real-time reporting" based on a survey of 300 professional investors, half of them representing institutions with more than US$500m in assets under management, which found that there is a significant level of demand for real-time reporting. They stated that real-time information allows them to better understand corporate performance and consequently improve their ability to react quickly. They also believe that surveyed believe that companies that would be able to provide real-time information are those that have more robust corporate governance and are more likely to attract investment from institutions [4].

3. Accounting's real-time reporting challenge and technological answers

Today, computer systems bring us a new meaning to "real-time". With computerized systems, real-time happens when input data is processed within milliseconds so that it is available virtually immediately as feedback to the process from which it is coming. A good example is a missile guidance system where the system directs and controls the missile along its entire course from its launch until it reaches its final objective [21]. Within an organization, the real-time reporting can be seen as something with a similar purpose. Along the organization life, the real-time reporting in accounting gives complete and instantaneous information about key dimensions of the organization allowing the management to decide the better direction and actions to take in each moment.

Actual information technologies, characterized by large computing power and huge data storage capacity, allow the production of reports combining different views of the organization, contributing to its competitiveness increase.

Fig. 2 shows the main technological answers to the real-time reporting accounting challenge identified by Belfo and Trigo, which are business process management, mobile devices, cloud computing, business intelligence, enterprise architecture and enterprise application integration [20].
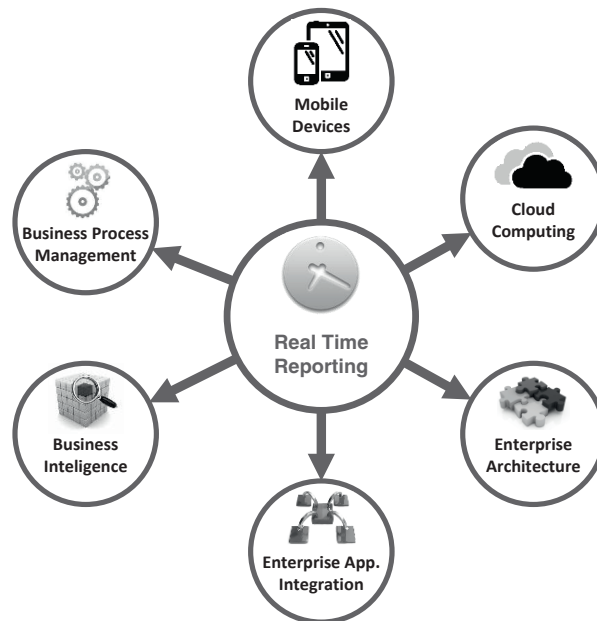

Fig. 2. Main technological answers to real-time reporting. Adapted from Belfo & Trigo (2013).

3.1. Business process management

Business Process Management (BPM) like accounting has lately been focusing one real-time issue to provide managers and business leaders the possibility to monitor and optimize business processes.

Business Process Management Suites (BPMS) have been progressing into a new era the era of intelligent BPMS, which include a new module the Business Activity Monitoring (BAM), which offers the ability to deliver real-time dashboards for monitoring all kinds of business processes.

The term BAM was originally coined by analysts at Gartner [22] and refers to the aggregation, analysis, and presentation of real-time information about activities inside organizations and involving customers and partners. BAM is an enterprise solution primarily intended to provide a real-time summary of business activities to operations managers and upper management. BAM.

Real-time accounting is connected to the need of continuous assessing of what is going on within business operations and processes in order to allow management to react promptly. In this sense BPM through the usage of BAM seems to be one of the best technologies for real-time reporting and continuous auditing implementations. BPM allows controlling internal organization internal processes allowing the establishment of internal controls that enable the automatically generation of financial and non-financial reports to be used by managers in the decision making process.

The implementation of BPM and BAM to produce metrics/inputs for accounting is a challenging process. Both domains share a set of key concepts like business processes, activities, task, transactions and events but with different perspectives, while accounting is focused on and identifying, measuring, and communicating economic information to management, BPM refers to the same concepts with the purpose of planning, implementing, and controlling how work is done in an organization. Sonnenberg and Brocke proposed the Process Accounting Model (PAM) to structure event records in process-aware information systems to enable process-oriented accounting [23].

3.2. Mobile devices

Smartphones and other mobile devices are here to stay and entered both in our everyday lives and in our professional life. In terms of business the great precursor of using mobile devices was Blackberry in 2001 with its mobile e-mail solution that allowed people that were on the go to access their professional e-mail without having to find a computer. Later Apple popularized smartphone concept with its iPhone among common people that began to take them to theirs jobs, starting a new revolution, the use of personal mobile devices within enterprises. As more and more professionals start using smart phones and other mobile devices to keep up to date with business information, as it is the case for financial and non-financial reports, the convergence between business reporting and mobility with special emphasis in real-time reporting seems obvious.

In order to provide business reporting in mobile devices the reporting format has to be different from the one accountants are used to. Information needs to be more focused on metrics, like key performance indicators (KPIs), and shown in more graphical way, which allows managers to assess the most important facts be it financial or non-financial.

Moreover, nowadays, companies providing business intelligence solutions, for instance like MicroStrategy, offer business analytics and reports on mobile phones and iPads (Mobile-BI product) allowing top executives to follow in real-time their company performance from the mobile phone [24].

Fig. 3 shows the "CFO dashboard app" an implementation of real-time reporting in a mobile device.

Fig. 3 CFO Dashboard [25].

Mobile devices have one important feature which is the possibility to receive notifications be it through mobile texting or e-mail. This is a very important feature in the context of real-time reporting since it provides managers alerts about their business operations allowing them to quickly react to business changes.

3.3. Cloud computing

Cloud computing has recently emerged as one of the key technologies for enterprises to adopt. It embraces a wide range of technologies but can be simply viewed as the services delivered by internet and the technologies, software and hardware, that support them [26].

According to IDC cloud offers many benefits to businesses as more modern user experiences, embedded analytics to support more effective real-time business decisions, embedded social collaboration tools to increase collaboration and productivity, pervasive mobile access to application services, ease of finding and sharing information to support collaborative decision making and increase productivity, user self-service to simplify provisioning and system administration, ability to more effectively tie back-office systems into the front office to support the company's customer experience strategy, eliminating data and people silos to make more effective business decisions more quickly, improve and shorten the financial close process through better access to data and embedded collaboration, balance the company's financial needs between capital and operating budgets [27]. Besides, cloud computing allows enterprises to have solutions with faster Return On Investment (ROI) and lower implementation costs [28]. Cloud computing has also the merit to allow Small and Medium Enterprises to access Accounting Information Systems, something that before was only affordable to large enterprises.

Among the several advantages of cloud computing like flexibility, scalability and lower upfront and maintenance costs the one advantage that is more interesting from the real-time reporting perspective is the possibility of anytime access from anywhere there's an Internet connection to different types of stakeholders to accounting reports [29].

There are numerous products in the market. Some examples are Oracle Fusion Financials, NetSuite Financials, Intacct Financials and Accounting System, SAP ERP Financials, Microsoft Dynamics GP, Epicor Financial Management or SAGE. Like in-house accounting software systems, the web-based accounting information solutions may vary according to the components they offer. According to Oracle, their Oracle Fusion Financials Cloud Service is a complete and integrated financial management solution with automated financial processing, effective management control, and real-time visibility to financial results.

3.4. Business intelligence

Hans Peter Luhn, an IBM researcher, used the term "business intelligence" for the first time in a 1958 article. He defined intelligence as "the ability to apprehend the interrelationships of presented facts in such a way as to guide action towards a desired goal" [30]. According to a Gartner's survey made to 1,400 CIOs, the business intelligence

(BI) projects were the first technology priority for 2007 [31]. Traditionally, business solutions are only affordable for large enterprises, but with cloud computing smaller business can also access to this technology.

BI includes two main activities. The first activity consists of getting the data in, which is also known as data warehousing. It comprises extracting data from several source systems into an integrated data warehouse. The second activity consists of getting data out from the system. It is usually associated to the traditional concept of business intelligence. It covers features like enterprise reporting, OLAP, querying, and predictive analytics. Yet, the Accounting Intelligence (AI), a new term that has recently emerged, differs from classical BI solutions in the way information is extracted. At classical BI solutions, information is extracted through a data warehouse or OLAP cube. On the contrary, at AI, information is directly extracted from the ERP at the time that a query is run [32].

BI supports strategic management, sustaining and validating the mission, vision and objectives of organizations. It also helps to evaluate the overall performance of the business and its progress towards objectives [20]. Furthermore, "the ability to apprehend the interrelationships of presented facts" [30] that BI provides, helps organizations to identify and develop new opportunities, at a strategic, tactical and operational level. Tailor-made dashboards can provide useful insights not only to top decisions-makers but also to middle managers. BI engages techniques like data mining, process mining, statistical analysis, predictive analytics or predictive modelling. Any of these techniques can support concerns as forecasting, identification and analyses of strategic options, decision support, strategic management accounting or business risk management [20].

An implementation of real-time reporting facilities in an accounting information system should have several business intelligence characteristics. Here, it is highlighted the importance of defining metrics and the selection of the best visual option, both of them correctly adequate to business and accounting objectives.

First, a hierarchy of metrics should be created to support the reporting. Metrics are used to help businesses focusing their people and resources on what's really important. They can also drive improvements on the organization. The BI provides "best-practice-based approaches and technologies to collect, report, and analyze metrics in an automated manner to all levels of an organization" [33]. The Metrics Reference Model (MRM) underlines the central importance of metrics on business intelligence objectives. It can be used to accelerate the development of and the improvement of the content of any organization's business intelligence solution. A comprehensive list of cost, process and performance metrics of possible interest to the organization should be provided. The definition of the metrics and its hierarchy should be developed through several steps: what is to be measured, why it is measured, when it should be measured, how it is measured, how measurements are calibrated, how are measurements reported and how measurements are used [34].

For instance, let´s see one the most important concerns for accounting: Accounts Payable (A/P). The three top goals for Accounts Payable were identified as reducing costs, reducing errors, and reducing the elapsed time from receipt of an invoice to posting it [34]. Now, imagine that an organization defines five calendar days as the maximum limit of how long it takes A/P to process invoices. Consequently, considering this is a key issue, organization defines a process metric that measures "how long it took A/P to process invoices". Metric is defined as the average number of calendar days that separates the moment a product or service was provided to a customer and the time its invoice was processed. With the help of appropriate components of the ERP system and its articulation, like the materials resource planning (MRP) or the supply chain management (SCM), it is possible to compute this metric. Based on future analysis of this metric, it is possible to install and use automated workflow to improve this or others aspects of business processes.

Another important aspect of BI is the selection of the best visual option to represent the data and achieve goals. Visualization is the process of representing data as visual images [35]. Nowadays, the challenge is to represent large amounts of data on a single screen (figure 3 presents a good example of this). Visualization is used to create advanced dashboard to do it. The selection of the best visual option has four objectives. It intends to exploit the human visual system to extract information from data, to provide an overview of complex data sets, to identify structure, patterns, trends, anomalies, and relationships in data, and also, to assist in identifying the areas of "interest" [35]. When we speak about accounting, data could involve, for example, abstract objects, such as profit, sales, or cost that should be accordingly represented.

The latest most important trend in accounting professionals is the shift of their responsibilities from traditional accounting operations to strategic management guidance and support [17]. Business intelligence technological possibilities may let that happen, providing real-time reporting with advanced dashboards specially designed for that

purpose. Also, new system facilities allow accountants produce reports interactively and autonomous, with an environment that allows them to choose what data to put in the reports, performing analysis and scenario creation.

3.5. Enterprise architecture and Enterprise application integration

Enterprise architecture can be defined as the fundamental organization of an enterprise embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution [36]. Enterprise architecture (EA) provides an integration framework that sits above the individual architectures and to provide the guidelines to define and establish interoperability requirements [37]. EA is closely related with Enterprise Application Integration (EAI). The integration of various applications that coexist in the organization, the sharing of their information and processes, usually known as Enterprise Application Integration strongly influences the design of enterprise architecture [38]. The accounting information systems should not work alone, but adequately integrated with other information systems in order to be more effective. "The ability to share information and services", usually referred as interoperability, allows the integration and embedding among information systems [37]. The classic architecture approaches are based on DMBS or rule engines. Yet, other architecture possibilities may combine these with other principles in order to ensure a real-time reporting system. Likewise, EA and EAI should consider modern approaches like the specific and powerful reporting languages or the integration capabilities of ERP systems, but also system performance aspects which may influence real-time reporting answers.

The XBRL, eXtensible Business Reporting Language (XBRL), an initiative lead by the American Institute of CPAs (AICPA), is a XML-based Web-based business reporting specification. It inherits the main objectives of the eXtensible Markup Language (XML), providing a method to tag financial information to greatly improve the automation of information location, retrieving and providing technical solutions to the resource discovery [39]. The XBRL strongly contributes to the exchanging of business information, allowing the expression commonly required in business reporting [20]. XBRL eases the preparation, the analysis, and the exchange of business information. By doing these, it allows the reduction of costs, the efficiency increase, and the improvement of accuracy and reliability for all involved parties in the business. The production of XBRL reports is done much more rapidly and efficiently than traditional PDF, HTML, or Word documents [40]. There is a conviction that XBRL reports may assist information consumers, such as investors, analysts, researchers, and value-added information intermediaries, in their decision making process [41]. One key advantage of XBRL is that it also makes real-time reporting easier. It allows companies to close their books much faster at the end of a financial reporting period. Moreover, it is possible that all reported items be based on real-time information. With the XBRL, financial and accounting professionals may monitor company transactions continuously for real-time allowing business decision-making or supporting audits [42].

An Enterprise Resource Planning (ERP), with its online, real-time transaction processing characteristics, can also deliver current rather than past information about firm's performance. Thereby, its real-time features allow augmented responsiveness to market environments and better inside competences [43]. Furthermore, an ERP system reduces the need or the complexity of the EAI. Yet, although the ERPs have a real-time nature, limited reporting capabilities are usually pointed as a problem. A survey based on responses from ERP project managers of 20 Canadian organizations revealed that 25% considered that ERP had limited reporting capabilities and so, that software did not supported the way the organization worked. According to one of these managers, one problem may be that: "ERP is a gigantic system; we do not have the staff to explore every corner of ERP to see what all the capabilities of ERP are" [44]. Among the desired ERP´s evolutions, the optimization of the existing tools utilization is one of the most cited (in second place in another study, with 20% of the responses), and the reporting is one of possibility of these considered optimization of the ERP´s utilizations [45].

Nevertheless, even considering that ERP were considerably optimized to support good reporting, other problems related to system performance may appear. An interesting use case about real-time reporting on service contracts came from Oracle. This case gives insights for how to architect and configure a real-time reporting solution. Before the current solution, Oracle faced problems at its internal operations, caused by an increasing volume of data from Sales, Operations, and Finance areas of the company, managing service contracts of Oracle's with an amount of $20 billion. The previous reporting system, a 10 year old contracts reporting solution, did not follow the change and the

2,000 potential users had to make do with stale data or un-performant reports with missing critical dimensions or attributes required to drive better decisions [46]. The preceding architecture was based on a global single instance of E-Business Suite. The new reporting system implemented by Oracle in 2011, used an Oracle´s solution called GoldenGate, and adopted a real-time data replication to an operational data store. Two other solutions were equated. First, a snap-mirror copying was considered. This solution considered a mirror-copy of production OLTP (Online Transaction Processing) systems to dedicated reporting instance. The bigger problem with this approach was that "Snap" copying would take more than 8 hours to be done. The other solution was the move of service contracts operational reporting from ERP to Oracle´s data warehouse. The problem of this solution was the daily/weekly refreshment cycle. Run a report with data with more than 24 hours old was not acceptable under a real-time approach. The chosen architecture, based on the GoldenGate solution, is centralized on a real-time data-integration software. Instead of doing batch ETL (Extract, Transform and Load) from the source database, the GoldenGate essentially replicates only the changed data. It monitors database redo (transaction) logs for change activity and acts based on that [46].

4. Conclusions

Nowadays, some accounting activities face special concerns that represent serious challenges. Of course, the implementation success of an accounting information system depends on technological issues, but other dimensions should be considered, like the people and the organizational dimensions [47, 48]. Yet, new technological solutions deserve a closer attention and may provide answers to the accounting challenge of real time reporting.

This paper presents contemporary main technological answers to one of the current concerns in accounting: the real-time reporting. The challenge of implementing real-time reporting in accounting information systems may be partially addressed by some technological answers like business process management and business activity monitoring (for instance, by supporting more extensive accounting reporting with several process metrics), mobile devices (for instance, by using the possibility of receiving immediate notifications), cloud computing (for instance, with different stakeholders accessing anytime or anywhere to accounting reports), business intelligence (for instance, by selecting the best visual option to represent the data and achieve goals), enterprise architecture and enterprise application integration (for instance, by using specific and powerful reporting languages, like the XBRL, which provide a method to tag financial information).

Although these issues are complex, deserving a more detailed research in the future, this paper presents a reflection about several aspects and practical considerations regarding real-time reporting implementation. Moreover, this is a theme in development and other fresh technologies could be cumulatively considered, like the involvement of Big Data architectures, already being used to perform real-time analysis [49]. We hope this work can contribute to enlighten practitioners and managers for the technological options that exist for the implementation of real-time reporting in accounting.

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