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Accounting Information Systems: Tradition and Future Directions

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Abstract

This article reflects about current and future role of Accounting Information Systems by analysing the main responsibilities of accountants and financial professionals. While several of these responsibilities are already suitably supported by traditional technology answers, others represent challenges that do still not have appropriate responses and therefore deserve to be the focus of future research. This work foresees future technological answers to Accounting domain challenges, like external and compliance reporting. The identified technologies include web services, mobile devices, cloud computing, environmental scanning, business intelligence, enterprise application integration, business process management, computer assisted auditing tools and techniques and big data.

Keywords: Accounting, Management Information Systems, Accounting Information Systems, Mobile Devices, Cloud Computing, Environmental Scanning, Business Intelligence, Enterprise Application Integration, Business Process Management, Computer Assisted Auditing Tools and Techniques

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1. Introduction

An Accounting Information System (AIS) is generally a computer-based method for tracking accounting activity in conjunction with information technology resources [1]. AIS is responsible for the collection, storage and processing of financial and accounting data that is used for internal management decision making, including nonfinancial transactions that directly affect the processing of financial transactions. Typically an AIS is composed of three major subsystems: (1) Transaction Processing System (TPS) that supports daily business operations; (2) General Ledger System and Financial Reporting System (GLS/FRS) and (3) the Management Reporting System (MRS) [2].

TPS is responsible for supporting daily business operations or transactions. These transactions can be grouped together in three transaction cycles: the revenue cycle, the expenditure cycle and the conversion cycle. The purpose of the first information systems was to automate business processes, which shows that the accounting domain was one of the very first to use information systems to support its activities [3]. Indeed the era of computer accounting launched with the appearance of the first computers, in particular, with the IBM 702 which became available for accounting use in 1953 [4]. Usually seen as a single integrated service, the GLS/FRS are two closely related systems, with the first one dedicated to summarization of transaction cycle activity and the second one to the measurement and reporting of the status of financial resources, generally outputted in the form of financial statements or tax returns to external entities [2]. MRS, usually in the scope of Management Information Systems (MIS), offers internal management with special purpose financial reports and information needed for decision-making such as budgets, variance reports, and responsibility reports.

For almost all professionals from the accounting domain, the main idea about the information system of an organization and particularly an AIS is embraced by the Enterprise Resource Planning (ERP), which encompasses all the essential functions to support an organization and is implemented in almost all large organizations [5, 6]. Current literature [7] is moving away from this established view about AIS domain, considering now a more modular approach to an AIS where new technologies like Business Intelligence (BI) or Balanced Scorecard (BSC) systems play an increasingly important role [3, 8]. The work presented in this paper surged from this idea that there is a huge set of new technologies that can complement or integrate current AIS and its present available facilities.

This paper presents a reflection, based on a literature review on the trends, challenges and answers of the AIS domain. It tries to uncover the new challenges facing the Accounting discipline and identifies some of the potential technology answers to those challenges. This paper is organized as follows. The second section presents the current tendencies and challenges facing the Accounting domain. The third section presents the answers to those tendencies and challenges. Conclusions and future work are presented in the final section.

2. Accountancy tendencies and challenges

In June 2010, a large online survey was conducted by the Chartered Institute of Management Accountants (CIMA) and by the UK´s University of Bath to 5,426 senior finance and senior non-finance professionals around the World [9]. The respondents of this study were a wide range of financial professionals, from all regions of the world, with responsibilities split into six categories: accounting operations, which includes transaction processing, accounts payable and receivable, and internal financial reports; external reporting, which includes statutory reporting, corporate finance, treasury and financial risk, and regulation, including internal audits, compliance with regulatory requirements, and taxes; preparing and interpreting management accounting information, such as forecasting, budgeting, costing and reporting on variances, as well as cash flow management; management support, which includes identifying and analysing strategic options, decision support, designing and tracking key personnel indicators, benchmarking, strategic management accounting,

and business risk management; developing, implementing and maintaining Management Information Systems; and other like staff management, training, administration, and other miscellaneous activities.

CIMA study showed that the latest most important trend in accounting professionals is the shift of accountants' responsibilities from traditional accounting operations to strategic management guidance and support. This trend, a consequence of the 2008 financial crisis, represents an increase of the value added to the organization and the contribution performed by accountants. Nowadays, major corporations worldwide need professionals who understand risk management, cash flow, financial instruments and other complex functions that can offer strategic guidance to top executives [9]. The results also underscored the need for financial professionals remain true to the traditional duties of accounting operations.

Reporting is probably the activity most frequently performed by accountants. Just as a curiosity, the word "reporting" appears 357 times in the Accounting Information Systems book of James Hall [2]. Accountants' need to be able to produce reports in real time and interactively (allowing them to choose what to put in the reports, perform analysis and scenario creation) without the intervention of the Information Technology team. Furthermore, with the recent international financial crisis, the usage of AIS by external stakeholders (external reporting) is becoming more important and specially, much more critical [9].

One activity that is usually performed by accountants is Auditing, usually divided in two major groups: Internal and External (or Independent) Auditing. Internal auditing covers a wide range of activities on behalf of the organization, including conducting financial statement audits, examining an operation's compliance with organizational policies, reviewing the organization's compliance with legal obligations, evaluating operational efficiency, detecting and pursuing fraud within the firm, among others [2]. Internal auditors need to support their activities with the use of Information Technology (IT) like Workflow Management Systems [10]. External auditors' activities are similar to those performed by the internal auditors but more focused on the specific laws or rules on the financial statements of an organization and not on operational matters [11]. External auditors represent third-party outsiders, whereas internal auditors serve the board of the organization [2, 11]. Audit firms are continually looking for ways to increase efficiency by performing focused audit procedures and are increasingly relying on effective internal audit departments and controls. Engagement teams are required to participate in brainstorming meetings to identify risks resulting from error or fraud, along with ways to address these risks. As a result, audit firms are increasingly turning to Computer Assisted Auditing Tools and Techniques (CAATTs) [12].

If on one hand it seems obvious that the new accountants' responsibilities like management support derived from the 2008 financial crisis require appropriate technological responses. On the other hand, some of the traditional accountants' responsibilities continue to present challenges and should not be neglected in a work that seeks to be a thinking on the answers that technologies can give to the needs of the Accounting domain. Thus, based on the literature review conducted, the most important concerns for accounting are [2-4, 12-16]: 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 (cost control, detailed reports about performance against budget) as well as cash flow management), management support (which includes identifying and analysing strategic options, decision support, designing and tracking key personnel indicators, benchmarking, strategic management accounting, and business risk management), staff management, training, scrutiny of capital projects, emphasis on customers and products, reports about debtor and creditor ageing, real time reporting, interactive reporting, auditing, internal controls implementation, risk management, error or fraud detection, accountability, among others. Several of these accounting concerns already benefit from traditional technology answers, most of them provided by ERP systems.

The focus of the present work is on the concerns that represent challenges that still do not have appropriate

technological responses and therefore deserve to be the focus of future research like, external and compliance reporting, strategic analysis, benchmarking, forecasting, internal auditing, internal controls, risk management, access and report nonfinancial data, analyse historical data, provide tailor-made and interactive reporting.

3. Technology answers

The alignment of Business and IT is still an important concern of both business and technological managers. Winning organizations depend on the alignment of these two worlds among its multifaceted dimensions (communications, competency/value measurement, governance, partnership, technological scope or skills) [17]. Due to its difficulty and complexity, this task certainly needs fresh perspectives to accomplish it, for instance, valuing workforce incentives [18, 19] or the role of knowledge management in this alignment [20]. Information technology, in particular its' support to AIS, has proven to have a positive impact on companies' performance and productivity [21]. Accordingly to Ismail and King the investment in AIS by Small and Medium Enterprises (SME), expands the scope of action, saves time in trips to and dealings with banks, the central administration, etc., reducing company's costs and increasing company's productivity (if the innovations are properly used) [22].

Fig. 1 presents the most important current tendencies and challenges around accountancy and finance, respectively linked with some technological approaches that should provide adequate answers to those challenges. Although other relations exist, the represented lines symbolize only the most important ones.

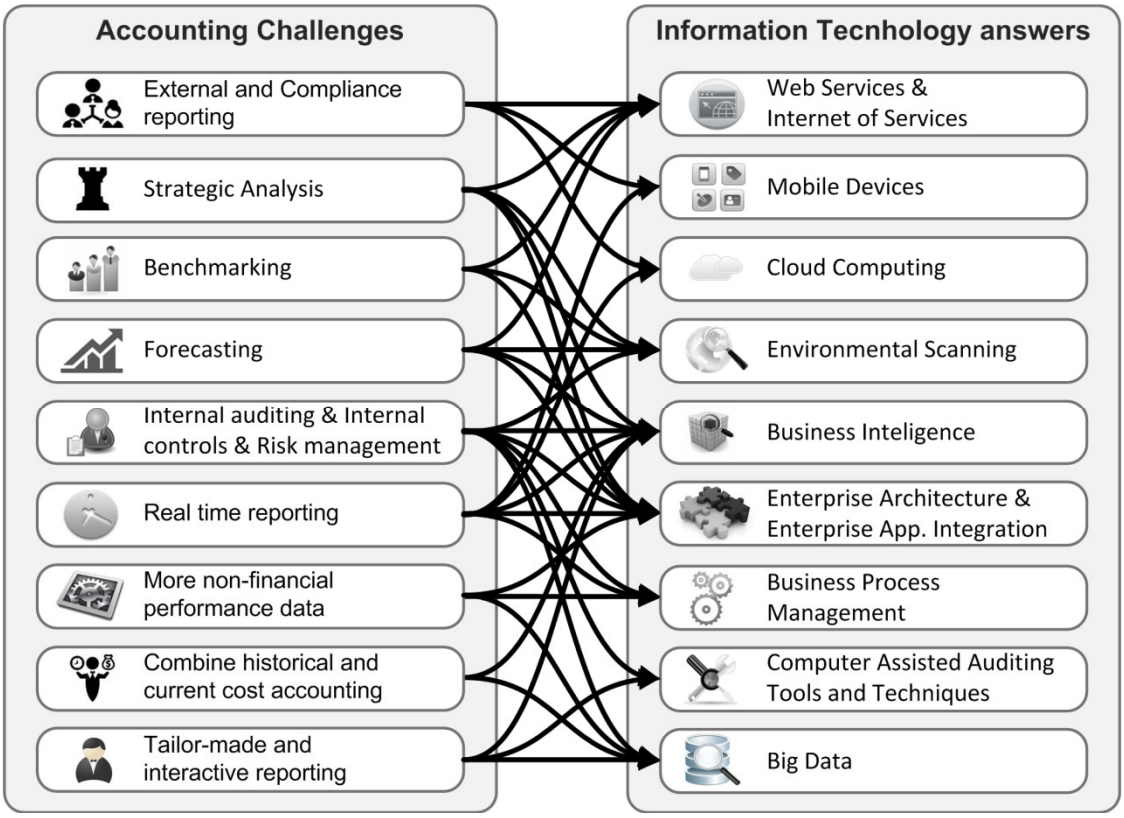

Fig. 1. Accounting challenges and its most important information technology answers.

Next, it is briefly explained how each IT approach responds to each accounting challenge.

3.1. Web Services & Internet of Services

Terms like Service, e-Service and Web Service are usually used to identify an autonomous software component that is uniquely identified by a uniform resource identifier (URI), accessed by standard Internet protocols such as XML, SOAP, or HTTP [23]. Web Services correspond to communication through the Internet. It facilitates Enterprise Application Integration (EAI), meaning integration among applications or interoperability among the information which circulates in an organization, like electronic commerce with clients and suppliers. Today, these services allow integration between different systems like AIS, operational systems and web applications. Definitively, they enhance external reporting and real time reporting, normally increasing information availability to a wider range of stakeholders, with almost a fulltime accessibility.

It is expectable that financial accounting information enhances economic performance by reducing adverse selection and liquidity risk [24]. Investors and creditors accessing to high-quality financial accounting information are more informed stakeholders and, consequently, have lower risk of loss or liquidity. Publicly traded organizations usually need to use online reporting of financial data. Besides this, organizations also use their Web sites to place their financial statements and other financial reports [25]. Significant part of this effort of external reporting is related with the organizational compliance. Some of these web services should allow external entities to make sure that the company is following all the necessary rules and regulations.

Besides the use of Web as a static container of financial information, there is a continued growth of web-based and web-enabled accounting software services. These offers include web services and web support around accounting [26]. The vision of the Internet of Services (IoS) describes an infrastructure that uses the Internet as a medium for offering and selling services which become tradable goods [23]. Among other services, online invoicing and online billing are frequently used by significant number of organizations, from small to big ones. Usually, these services are supported with payment processors like PayPal, Authorize.net, 2CheckOut or Linkpoint. These gateways ensure that the transactions are secure, fast and reliable, providing the necessary infrastructure and respective security.

Other new services can be designed to support accounting and finance, like helping to provide strategic guidance, looking at what is happening outside, forecasting (now and future) or benchmarking (comparing one's business processes and performance metrics to industry bests or best practices from other industries).

3.2. Mobile devices

The mobile revolution, provided via wireless technologies, brings impressive changes to civilization. It influences many aspects on the way business is conducted, providing significant data in real time and anywhere to help decision makers, influencing communications between businesses and their customers, and transforming the way we live our lives. Yet, the mobile services also face challenges which include business strategies, investment risk, limitations in mobile devices, networking problems, infrastructure constraints, security concerns, and user distrust in mobile applications [27].

According to a survey conducted by Oracle to more than 3,000 mobile phone users around the world, although consumers prefer to purchase in store, they use mobile and other channels to support shopping experiences. Also, 24% of mobile users have read customer reviews on their mobile phone and 55% said they use or would like to use banking/finance applications on their mobile phone and tablet computer [28]. This tendency reveals the importance of the m-commerce to organizations, and so, the importance of integrating these systems and their performance data with the AIS. It also highlights the importance of organizations using mobile channels to make possible real-time reporting, supporting communication with their current and

potential investors, creditors, fiscal or regulatory authority, increasing the information availability to a wider range of stakeholders and thus the attraction in the organization. Today, there are business intelligence (BI) solutions, like the Mobile-BI product from MicroStrategy, which offers business analytics and reports on mobile phones and tablets, allowing executives to follow their company performance from the mobile [29].

3.3. Cloud Computing

With the spread of web-based systems, it is more common to have web-based accounting software, reducing of solely on-premise or in-house accounting software. The technological answer may range between an hosted solution, a mixed online and on-premise solution or an wholly online accounting software, with a solution based on the cloud , which means an architecture based on Software-as-a-Service (SaaS), also known as Cloud Computing [26]. Contrary to an hosted application, running on an off-premises server, but not necessarily managed by the application provider, SaaS customer is running the same instance of the accounting information system without, of course, sacrifice the customizability (like the branding).

Today, an application can run much more instances at the same time, in a common environment, due to new software design and delivery models. McKinsey 2006 survey of senior IT executives pointed to an impressive jump in the number of companies considering SaaS applications during 2007. SaaS offers some advantages, as more frequent and probably less troubling upgrades, a lower cost of ownership, and a higher level of service from vendors (proportional to subscription) [30]. With this kind of solution, different sort of stakeholders can access to solid accounting and finance management functionalities with real time reporting from anywhere there's an internet connection. Examples of these products are NetSuite Financials, Intacct Financials and Accounting System, SAP ERP Financials, Microsoft Dynamics GP, Epicor Financial Management or SAGE. Like in-house accounting systems, the web-based accounting information solutions may vary according to the components they offer. Most important components are core accounting, project accounting, fund accounting, inventory management, billing & invoicing, work order management, budgeting and forecasting, fixed asset accounting, financial reporting, payroll management or human resources.

3.4. Environmental scanning

Environmental scanning can be defined as the acquisition and use of information about events, trends, and relationships in an organization's external environment, the knowledge of which would assist management in planning the organization's future course of action [29]. Organization still neglect external information. Yet, it remains crucial to take strategic decisions. So, it is important to develop systems which can look for external information that can be used to help organization. For instance, historical costs has usefulness, but they are insufficient for the evaluation of business decisions. The centre of attention of conventional accounting on the stewardship function of accounting is important but should not be its only focus [30]. Another cost perspective is the current cost. It corresponds to the price that must be paid for an asset or its use at the date of the balance sheet or the date of the use. Some scholars are inclined to combine historical and current methods. Although hard to implement, current cost accounting gains with environmental scanning.

The environmental scanning helps to build a more complete view. Its capabilities support strategic analysis process by enriching the knowledge about important external aspects. It also allows benchmarking by gaining more understanding about the market and competitors. Moreover, some external information, like current or future prices of products or interest rates, may help to predict tendencies or identify and manage some risks.

3.5. Business Intelligence

Strategic management provides overall direction to the enterprise. Yet, in order to be able to support and validate their mission, vision and objectives, organizations need to evaluate the overall performance of the business and its progress towards objectives. By handling large amounts of information, the BI helps to identify and develop new opportunities. Also, BI helps organizations not only at a strategic level, but also at a tactical and operational level, providing useful insights which help not only top decisions-makers but also middle managers, offering tailor-made dashboards. BI often engages processes like data mining, process mining, statistical analysis, predictive analytics or predictive modeling, which can support some management accounting concerns like forecasting, or some management support concerns, like identifying and analyzing strategic options, decision support, strategic management accounting or business risk management.

The last Computerworld´s survey about salaries showed that future recruitment (corresponding to the next 12 months) will give priority not only to traditional IT skills like application development or help desk support, but also to some newer skills, such as business intelligence, cloud computing and mobile development [31]. This survey also evidenced that business intelligence analyst was the job title with the highest increase in total compensation comparing to 2012 report. According to Job hunters, companies are seeking IT professionals "who can speak tech and business with equal ease".

Recently, a new term has emerged: accounting intelligence (AI). The accounting intelligence is a specialist type of business intelligence, an expression meaning a set of technologies used to extract, analyse and present information from accounting and ERP applications. One important difference between classical BI solutions and AI is in the way information is extracted. At AI, information is directly extracted from the ERP at the time that a query is run. On the contrary, classical BI solutions extract information through a data warehouse or OLAP cube. SAGE offers an interesting solution called Sage Simply Accounting Intelligence which link directly to Sage Simply Accounting system, offering real-time information [32].

3.6. Enterprise Architecture & Enterprise Application Integration

The provision of an holistic view of the enterprise is the most important characteristic of the enterprise architecture. This higher systems integration brings together information from formerly unrelated domains [33]. Among others aspects, an enterprise architecture should provide an integration framework that sits above the individual architectures and the guidelines to define and establish interoperability requirements [34]. Usually, the design of an enterprise architecture strongly depends on the integration of various applications so that they may share information and processes freely. This is usually called by the buzzword Enterprise Application Integration (EAI) [35]. Interoperability characteristics, that is to say, "the ability to share information and services", allows accounting information systems be more integrated or embedded with other systems, and consequently, be more effective. The eXtensible Business Reporting Language (XBRL) contributes to that purpose. XBRL, a XML-based language, is a freely available and global standard for exchanging business information, allowing the expression commonly required in business reporting.

An integrated and multifaceted architecture enables some of the presented accounting challenges like strategic analysis, benchmarking, forecasting, internal auditing, internal controls, risk management, real time reporting and the combination of more non-financial data. For example, most organizations comprise financial reporting as a batch process, due to its periodic nature. However, numerous organizations have now real-time updating of general ledger (GL) and financial reporting system (FRS) producing financial statements in the nick of time [23]. Real time reporting capability of systems depends on the level of its integration. Theoretically, the more applications are integrated, faster the reporting can be done.

ERP systems usually plays the higher attempt to integrate. Yet, ERP do not support significatively the reporting and analysis, budgeting, non-financial, external and ad-hoc management accounting, and allocation of costs. Strategic enterprise management (SEM) systems seems to better support management accounting, namely changes among those practices. ERP and SEM systems are complementary. ERP systems appear to be the primary enablers of change in data collection and organizational breadth of management accounting, while SEM systems seem to be the primary enablers of change in reporting and analysis, budgeting, non-financial, external and ad hoc management accounting, and allocation of costs [5]. Concerning management accounting tasks, although ERP and SEM systems are distinct, it is crucial strengthen the way which led organizations to higher levels of information integration not only among those two systems but also with others. An important attempt to have a global view is the Corporate Performance Management (CPM) system. CPM, or business performance management or enterprise performance management (EPM), is the area of business intelligence (BI) involved with monitoring and managing an organization's performance, according to key performance indicators (KPIs) like revenue, return on investment (ROI), overhead or operational costs.

A higher integration enhances reporting with varied types of data, powering new functions and capabilities. The holistic view provided by EAI and enterprise architecture also allows a better strategic analysis.

3.7. Business Process Management

Significant thematic initiatives, like Customer Relationship Management (CRM), Enterprise Resource Planning (ERP), Six Sigma, and more recently Business Process Management (BPM) refer process has an important and central concept. Research about ERP critical factors of success and benefits, evidence that, from a business perspective, the system deployment stage 'includes the definition of the documentation, analysis, improvement, control and redesign / reengineering opportunities of all the most critical processes and core activities' [36]. Processes is a common factor along all organizations. Processes are 'the way things get done' [37]. Some authors stresses the importance of processes calling them 'strategic assets'. For example, Kaplan and Norton refer a "Strategy Map", with intangible assets which influence company's performance by enhancing the internal processes most critical in creating value for customers and shareholders [38].

Good decisions must have information as complete as possible. Preferably, essential pieces of information should be included to enrich the reporting, including different sort of data, like specific performance data coming from workflow of all main processes [23]. The dematerialization of processes allows that BPM better support the delivery of non-financial data to accounting information systems. Whether at an operational level, or at strategic level, the management of processes also administrates indicators of performance and of other types. Mature process applications fully explicit processes, with suppliers and customers being seen as part of the organization [39]. Material, human and other production costs or performance indicators of the processes can be managed at a lower or at a higher level. BPM, with its workflow functionality accordingly integrated within AIS, facilitates the analytic accounting and real time reporting because it allows a detailed analysis of processes and so, helps the direct allocation of costs and revenues to specific cost or revenue centre.

3.8. Computer Assisted Auditing Tools and Techniques (CAATTs)

Auditors need Computer Assisted Audit Tools and Techniques (CAATT) to enhance capabilities and productivity. Many such tools and techniques can be implemented at minimal cost and relative ease, ranging from maximized use of standard office suite software to Audit Command Language (ACL) and Interactive Data Extraction and Analysis (IDEA) for the extraction and analysis of data [40]. These tools can be used to perform a wide range of analytical procedures on various financial data including general ledger entries, payroll and accounts payable data and trial balance calculations to flag outliers, miscalculations, or suspicious

entries that might indicate the presence of fraud or misstatement [41]. These tools allow the implementation of continuous auditing concept, which allows continuous risk assessment, trough audit activities that identify and evaluate companywide risk levels by examining trends in the data-driven risk indicators within a single process or system, comparing to their past performance and other business systems; and continuous control assessment that identify whether key controls are working properly [40].

3.9. Big Data

Big companies always generate large amount of data. Corporate business manage several businesses. Accounting and financial information from these different businesses across the world join large non-financial data. Yet, today, businesses from all dimensions tend to produce much more data than they created in the past. According to Phil Ostwalt, a partner in KPMG, as more and more business activities are captured electronically, it is important to ensure that companies have the correct technology and resources to manage data analytics and big data challenges inherent in all compliance arenas [40]. Internal auditing, internal controls and risk management are areas where the big data may represent an important answer.

This great amount of data brings new and specific unfamiliar challenges to most developers. Big data techniques are important to answer these challenges. The big data systems paradigm is supported by scale, parallelization, and agility, using numerous machines working in parallel to store and process data.

4. Conclusions and future work

As shown in this paper this work identifies many of the concerns and challenges of the Accounting domain to which the response from the current technology is still deficient. Technology answers identified and characterized in this work can also be viewed as the future directions of research in the domain of AIS. Although AIS research undoubtedly includes ERP systems, other emerging systems such as the ones identified in this work are also important [3]. Unlike ERP systems, these new systems are not so thoroughly studied in the AIS domain, so more research is needed to discover new potentialities and/or benefits that these systems can bring to the organization's management and how they impact the role of the accounting function.

The authors developed this work as the cornerstone for future research in the area of Accounting Information Systems. The vast directions indicated in Figure 1 of this paper, which presents the most important relations between the challenges and technological responses, are pointing out the way for future research in order to improve the alignment between technology and organization, in this particular case the support of management information systems to accounting and management.

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