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Accounting Information Systems: evolving towards a business process oriented accounting

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Abstract

This article presents a reflection on the role of Business Process Management and associated technologies on supporting/evolving current Accounting Information Systems. Although traditional Accounting Information Systems fulfill the need of financial reporting, collecting data from central databases and consolidating it, so that the information can be easily consumed by decision-makers, they were not created bearing in mind the idea of performing business process oriented accounting. Organizations have always worked in a business process oriented way either implicit or explicit. Business Process Management adoption as a management practice has been gaining popularity in recent years, making sense an evolution of Accounting Information Systems towards a business process oriented accounting supported on a Business Process Management Suite. The benefits of this evolution include, among others, the flexibility and agility in business process redefinition, the empowerment of knowledge workers, the implementation of control points for data collection to produce real-time reports and alerts relating the use of financial and non-financial information, so that decision-makers can act on.

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1. Introduction

Organizations have always worked oriented to processes in the sense that they perform a sequence of activities that consume resources for the production of goods and/or provision of services in order to create value for the customer and for the organization, but only recently with the popularization of Business Process Management (BPM) organizations began explicitly to systematize and formalize its processes. This new way of thinking and managing the organization impacts the accounting and information systems that support it in two perspectives. The first relates to the fact that traditional Accounting Information Systems (AIS) were designed for the collection and reporting of important financial and non-financial information to the organization, but have been process unaware, not being able to produce fuller information, not only considering traditional accounting perspectives, but also covering the cost / economic value behind the main processes of the organization. This clearly represents an opportunity to rethink the traditional AIS so it encompasses this new perspective. The second perspective has to do with the potentialities of Business Process Management Suite (BPMS) regarding financial and non-financial information gathering in the organization. This type of system allows, for example, the organization to implement control points in processes to collect and send to decision makers, through alerts or messages, financial and non-financial information, in real time, which allows decision makers to act in the moment and not at *posteriori*, something that happens with traditional AIS.

The BPM methodology and the great recent development of technologies that support this methodology as a BPMS allow a new approach, which is the business process oriented accounting, and potentiate a more efficient gathering of financial and non-financial information, which present work aims to present and explore. The work presented here is conceptual in nature and aims to pave the way for the creation of AIS oriented to the organization's business processes, based on existing literature. This paper is organized as follows: the second section presents the emergent reality of BPM technologies in organizations, namely a BPMS; the third section presents the traditional AIS and its limitations regarding the new reality of BPM; the fourth section embraces the relation between accounting and BPM and the concept of business processes oriented accounting; and fifth section presents the benefits of using this new approach. Conclusions and future work are presented in the final section.

2. Emergent reality of BPMS adoption in organizations

Processes are a common factor along all organizations. Processes are 'the way things get done' [1]. Some authors stress 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 [2].

A business process is a complete, dynamically coordinated set of activities or logically related tasks that must be performed to deliver value to customers or to fulfil other strategic goals. Processes can be classified by their value in the chain target: core processes (primary activities of the chain value), are central to basic business operations and directly related to serving the external customers; support processes (secondary activities of the chain target) frequently have internal customers and consist of the supporting activities of core processes; business network processes extend beyond the boundaries of the organization including also suppliers, customers and allies; and management processes are those by which the company plans, organizes and controls resources [3].

Although BPM definitions focused more on Information Technology (IT), such as the definition proposed by Van Der Aalst [4] – "supporting business processes using methods, techniques, and software to design, enact, control, and analyze operational processes involving humans, organizations, applications, documents and other sources of information" – we prefer to focus on the definition of BPM as a management discipline proposed by Paul Harmon [5] – "aligning processes with the organization's strategy goals, designing and implementing process architectures, establishing process measurement systems that align with organizational goals, and educating and organizing managers so that they will manage processes effectively". Nonetheless, in our believe, the secret for BPM recent success has to do with the fact of BPM being so strongly IT based.

BPM is a holistic management discipline that uses technology to control and operate the entire business through rules that clearly defines business processes. BPM is about continuous improvement and optimizing processes to ensure high performance and by that achieving agility and flexibility as a tool to gain competitive advantages [6]. A key benefit of BPM is the ability to adjust business processes accordingly to changing market requirements, since

business process are dynamic [7], allowing businesses to respond more quickly and cost-effectively to changing market condition [8].

BPMS, along with Service Oriented Architecture (SOA) and web services, is the technology that enables the fully use of BPM potential, supporting the entire process lifecycle, from modeling through execution to monitoring within the organization [6, 9]. The ability of a BPMS to handle several processes at the same time, to simulate changes in processes and measure their impact as well as establishing rules so that processes automatically adapt to changes in the market makes use of a BPMS a truly advantage compared to other existent enterprise information systems [6]. BPMS contains more BPM-enabling technologies, such as [9]: orchestration engines, business intelligence and analysis tools, rules engines, process repositories for reuse, simulation and optimization tools and integration tools. Recent BPMS also focus on connecting people across applications allowing people to share knowledge and extending their access to the information needed to do a job. Messaging and collaboration are key aspects of BPM to make processes more efficient. When people can work things out as a problem occurs, then the delays are eliminated and the business runs far more efficiently [10].

In parallel with BPM and BPMS cloud computing service model has emerged to provide a more cost effective solution to organizations [7], helping to promote the adoption of a BPMS in its Software as a Service (SaaS) cloud computing service model, given the advantages associated with SaaS, namely [11-13]: unleash the organization from installing and maintaining applications and required infrastructure to run them, lowering the Total Cost of Ownership (TCO); promoting a higher level of service from vendors (proportional to subscription); lowering upfront costs; reducing the cost and effort of upgrades; freeing internal IT resources to be used elsewhere; improving the infrastructure scalability and manageability. With this kind of solution, different sort of stakeholders can access to solid accounting and finance management functionalities like financial and non-financial reporting from anywhere there's an internet connection. Like in-house accounting systems, the web-based accounting information solutions may vary according to the components they offer, being the most important ones, 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 [14]. Although Cloud BPMS appeared in the form of SaaS, other vendors present them as a Platform as a Service (PaaS) cloud computing service model, since BPMS enables the creation and deployment of applications, which allow the execution of customized business processes. The merge of BPM and Cloud concepts, led to the propose by Forrester Research of a new cloud computing service model, Business Process as a Service (BPaaS) [15], which combines business process management and SaaS concepts.

In a search for the most recent rate of BPMS adoption, be it in the traditional form or in the more popular form of cloud computing service model, we found two studies of commercial nature, one from WinterGreen Research stating that the actual \$3.4 billion market will reach \$10 billion by 2020 [10] and another one from Market Reports Hub stating that the BPM market will grow from \$4.71 billion in 2014 to \$10.73 billion by 2019, with a compound annual growth rate of 17.9% [16].

3. Traditional AIS

Traditional AIS focus on registering business transactions within the different business cycles, namely: the revenue cycle, which involves the activities of selling products or services and collect payment for those sales; the expenditure cycle, involves activities of buying and paying for products used by the organization; the human resources/payroll cycle, which involves the activities related to hiring and paying employees; the production cycle, which involves the activities for converting raw materials and labor into finished goods; the financing cycle, which involves the activities of obtaining the necessary funds to run the organization, repay creditors, and distribute profits to investors (see Fig. 1). The several transactions that occur in these cycles are stored in the AIS database. Beyond recording the data about an organization's transactions AIS fulfill two more basic functions, to provide management with information useful for decision making and to provide adequate internal controls [17].

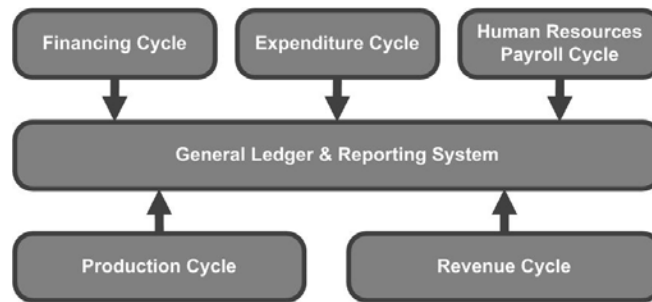


Fig. 1. AIS business cycles. Adapted from: [17]

An AIS is generally a computer-based method for tracking accounting activity in conjunction with IT resources [18]. 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) [19]. TPS is responsible for supporting daily business operations or transactions. 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 [20]. 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 [19]. 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.

The idea of an Information System for accounts is usually embraced by Enterprise Resource Planning (ERP). The exception goes to micro or small and medium enterprises that use specific software for accounting or that outsource the accounting function not having an integrated view of the enterprise. An ERP is usually composed by several packages or modules to collect data from transactions happening across all functional areas in an organization and store it in a central database. This established view regarding AIS, carried out by ERPs, is changing to a more modular approach [14, 21] similar to BPMS that interact with other systems using SOA and web services technologies. AIS were not created bearing in mind an orientation to business processes but an orientation to transactions, which makes it difficult to bring them into line with the new reality of BPM discipline within organizations. For instance, traditional AIS like ERP systems may not be process-oriented from a data perspective, as the data related to a particular process is not accessible from a central data source but is, instead, distributed over multiple tables without direct reference to the processes to which they belong. Accounting data in ERP systems contains few, if any, references to the process instances that create or manipulate accounting data [22]. Some disadvantages or limitations of traditional AIS (ERP system) when compared to process-oriented AIS (BPMS based) include: ERP customization, which is sometimes problematic forcing the organization to adapt to the ERP structure when it should be the other way around, something a BPMS does well since they are oriented to the true organizations processes; ERP flexibility, translated in the difficulty to automatically adapt to changes in the market, i.e., to redesign business processes, something a BPMS is tailored to do; ERP implementation difficulty in decentralized organizations with disparate business processes and systems, which a BPMS tries to implement using SOA and web services; ERP reporting is not real-time oriented, it is more focused on data consolidation; and implementation of internal controls, ERP internal control implementation is data focused while in a BPMS is process focused.

Although we consider BPMS, with the appropriate adaptations, as the way to go regarding process oriented AIS, ERP systems are currently evolving towards embracing BPM allowing for more flexible process definitions and changes.

4. Adjusting the world of Accounting to BPMS

Accounting serves the following two functions in most firms: financial accounting, which reports financial status of a firm for certain stakeholders as shareholders, banks or the tax administration; and management accounting, which provides cost analysis for internal decision-making and strategic planning [23]. The increasing adoption of enterprise information systems focused on BPM approach and associated technologies, particularly BPMS, requires rethinking on how accounting, especially management accounting, is carried out within the organization, i.e., accounting can evolve in order to focus on entire processes and not on isolated transactions. It should be possible to log all transactions associated with a particular process and report financial and non-financial information regarding the process. An example of this situation is the production of a particular product. From a traditional point of view, accounting includes registering costs and revenues (journal entries) relating to the production of a particular product, in a aggregated way, not showing detailed financial (and non-financial) data associated with part of that particular production process. For instance, it would be useful to have not only the aggregated data about the process, but also detailed data relative to the activities that comprise the analyzed process. Although some accounting systems and instruments seek to present the costs and revenues by product, the truth is that these systems are more focused on the production of reports based on account items (classification), for further balance sheet producing. This reality, from management point of view, is not always the best, as it is the case for product price setting policy which in some strategies depends on how much they cost [24]. To know how much a product costs, or better, to know how much a product costs in a given date (e.g. today) to be manufactured, we must assess the costs associated with the product manufacturing process. A methodology that resembles to BPM to assess the cost of a product is the Activity Based Costing (ABC) methodology [24], but even this, in our opinion, should be process oriented and not product focused.

The transition to a process oriented accounting needs a BPMS able to produce appropriate accounting information for decision making, something that still does not happen. The lack of process-related accounting data in a BPMS causes several dysfunctional effects in the context of planning, designing and controlling business processes, namely [22]: existing methods for operational decision support in BPM are focused on technical and structural criteria, not on economic criteria; cost calculations in BPM lack solid ground from accounting; economic implications of processes states are not accounted for, i.e., accounting information, such as, resource expenses, current inventory, resource consumption, current sales, is usually not readily available in a BPMS, making it difficult to conduct sound economic analyses; economic reciprocity, i.e., the idea that processes create not only costs but also income, is not accounted for; and finally, due to lack of process oriented accounting data, strategic BPM decisions are often on subjective plausibility considerations.

BPMS records operational information regarding the processes that are being implemented, including the information concerning the tasks performed by the process, in databases, and information on the state of change processes (events), recorded in event-logs. This information is of operational nature and not of an economic nature need for accounting. Our paper focus on the idea of giving to a BPMS the infrastructure to support the recording of economic events, accountants' core task. A common production cycle considered in accounting is the 4-4-5 calendar, where each quarter has 13 weeks, grouped into two 4-week "months" and one 5-week "month". Another possible accounting production cycle is to consider 13 accounting periods with 4-week each. The BPMS allows the implementation in practice of shorter periods of accounting, possibly, evolving to almost "real time accounting".

Sonnenberg and Brocke [22] propose an approach that can be used within BPMS, focused on "event" concept, that is a new event-log data structure to satisfy the information needs of both accountants and business process managers. This approach has as central theory the "events" approach to accounting theory, in opposition to the traditional double-entry bookkeeping theory, which suffers from several dysfunctional defects, namely [25]: measurements expressed only in monetary terms; inappropriate classification schemes; highly aggregation level of stored information; and lack of integration with other functional areas. The "events" approach to accounting theory looks at the accounting not only as a discipline for producing financial results but in a more contemporary model where accountants' produce also information for management guidance and support [14, 26]. The Resource Event Agent (REA) proposed by McCarthy provides patterns to structure event-based accounting infrastructures accommodating a process oriented view of enterprise. Base on this model Sonnenberg and Brocke [22] proposed the Processing Accounting Model (PAM), which proposes four design principles that should guide the implementation event-accounting information system to run in a BPM context, namely through BPMS: event-data desegregation, which allows event data to be used

by several audiences and analysis and not favor a particular interpretation; event classification, to allow for multiple perspectives on data, integrating for instance, economic events specifications into process models; process relatedness, which states that event data refer to a process context in which it occurred in order to facilitate reasoning about event dependencies that are determined by the process structure; and economic reciprocity. Other proposals [27-29] to address this new paradigm facing accounting reality to move towards process oriented accounting do not seem to us to be so BPMS focused as the model of Sonnenberg and Brocke [22]. Nonetheless, this model is still in the research domain, going certainly to appear in the future new proposals/solutions for adequacy of accounting to a BPMS.

Fig. 2 shows a conceptual model proposed by the authors for an architecture of a future business process oriented accounting information system where the BPMS is responsible for communicating with all existing systems within an organization as opposed to ERP systems that integrate everything in one system.

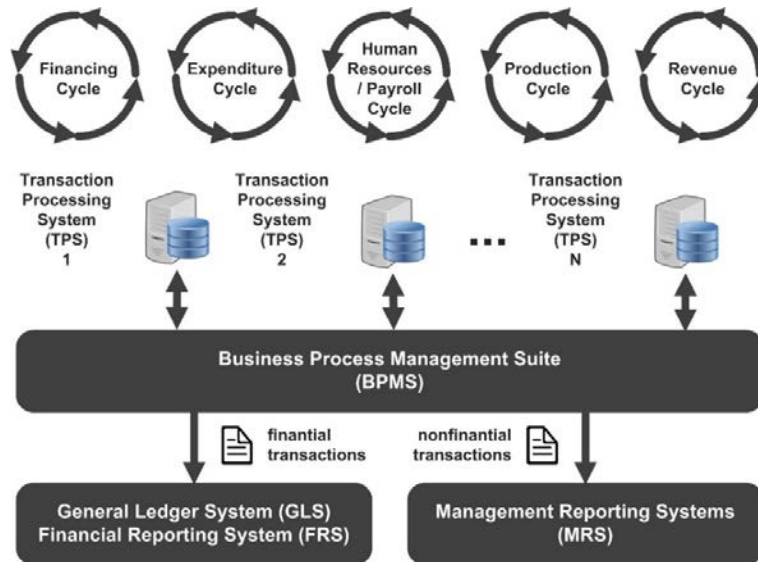


Fig. 2. Proposal of a business process oriented accounting information system

In the presented model, the BPMS, is the responsible for the aggregation of the relevant data concerning each one of the key cycles, namely, financing, expenditure, human resources/payroll, production and revenue cycle. Through an adequate interoperability, BPMS supports the new AIS, interacting with the transaction systems, responsible for the direct management of those key cycles, acting as an umbrella that integrates and filters all necessary information to the AIS.

5. Accounting benefits of adopting a business process oriented accounting based in BPMS

Accounting challenges identified in a previous study include [14]: 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 analyzing 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.

Table 1 presents the benefits of adopting a business process oriented accounting based on BPMS grouped by the above accounting challenges.

Table 1. Benefits of adopting a business process oriented AIS

Accounting challenge	Benefits
Accounting operations	<ul style="list-style-type: none"> • BPM increases process flexibility and agility diminishing redundancy and cost [8, 30]. • BPMS empowers knowledge workers to contribute to the redefinition of accounting operations processes [31].
External and compliance reporting	<ul style="list-style-type: none"> • BPMS allows enforcing compliance in reporting since regulations can be formalized and implemented in the BPMS.
Management Accounting	<ul style="list-style-type: none"> • BPMS allows operational control of processes. • BPM allows management to operate business processes more reliably, faster, and more efficiently [30]. • BPMS makes it easier to obtain performance key indicators (PKI) from processes and activities. • BPMS improves the automatically allocation of costs and revenues to a specific cost or revenue center.
Management Support	<ul style="list-style-type: none"> • BPM improves the formalization and institutionalization of process-related decision making at various organizational levels [32]. • BPMS allows obtaining non-financial information from business operations to management. • BPM governance model that embeds technical and managerial capabilities improves organization performance [33].
Strategic analysis	<ul style="list-style-type: none"> • BPMS event-logs allows better understanding of how business operations and processes are performing in order to not only optimize daily business operations through process redesign. • BPMS event-logs allows the identification of business needs that can lead to new product ideas.
Forecasting	<ul style="list-style-type: none"> • BPMS provides atomic real-time data, which allows a more targeted and quickly identification of deviations and trends in underlying business operations.
Internal auditing, internal controls and risk management	<ul style="list-style-type: none"> • BPMS allows the establishment of internal controls that enable the automatically generation of alerts or messages to management. • Analysis of BPMS event-logs enables management to perform internal auditing and risk management in a more thorough way. • Business Activity Monitoring (BAM) allows the implementation of continuous auditing [34].
Real time reporting	<ul style="list-style-type: none"> • BAM offers the ability to deliver real-time dashboards for monitoring and optimizing business processes [34].
More non-financial data performance data	<ul style="list-style-type: none"> • BPMS excels when compared to traditional AIS in this function, since they are focused on business processes while traditional AIS are focused on financial transactions.
Tailor-made and interactive reporting	<ul style="list-style-type: none"> • BPMS through BAM can contribute to the implementation of functionalities that allow tailor-made and interactive reporting. • Knowledge workers may more actively participate on report design [31]

6. Conclusion

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) [35]. IT, in particular its' support to AIS, has proven to have a positive impact on companies' performance and productivity [36].

BPM and Cloud Computing Service Model proposed as technologies answers for accounting challenges in a previous paper [14] are, like it is possible to derive from this paper, not only increasing their presence in organizations

but also shaping the future nature of accounting, presenting a new challenge to the accounting - the challenge of business process oriented accounting.

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