

Daniela Mancini
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Accounting Information Systems for Decision Making



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Accounting Information Systems for Decision Making

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Foreword

I am very pleased to have been invited to present the foreword to this book, mainly on research presentations at the 2012 Annual Conference of the Italian Chapter of AIS (ItAIS). I also have interest in sharing research development ideas in Accounting Information Systems (AIS), as AIS is the field which expresses the contemporary inter-connection of research questions with future research contributions, *par excellence*.

Researching AIS problems, tools, and outcomes, provides important distinctions that identify the research area. Like any other field that follows a systematic research development and analysis, AIS researchers as individuals or groups of collaboration, communicate important aspects. Research quality is similar to the alignment of a three-legged stool: there is multi-directional balancing in (a) offering an understanding of relevant concepts and properties in the field, (b) which processes and systems of governance are relevant, and theoretically justified, or indeed there is need to build theory related to them, and (c) which areas of expansion in both theory and applications the AIS research field may contribute to. To accomplish these “trends” in the continued development of AIS research, we globally observe several significant examples, and the 2012 ItAIS is certainly to be congratulated for carrying out such a task.

AIS research should have a broad perspective. In a field that attracts multiple issues (multi-selective) of research, it is also characterized by pluralities in theories, research topics, approaches, and outcomes. While it might be easy for a reader to determine there is a tradeoff between plurality and intellectual focus, we can only predict that any such condition only improves research environments. Indeed, as too diverse a set of interests may dilute the field’s focus and effect, on the other hand, many think plurality is what makes AIS research exciting and strong. With the potential mis-thinking that strong fit fields will emerge as the most narrow-thinking and least creative, a “scientific revolution” cannot be formed to dynamically change situations. As has very well been said in related fields as ours, there are very committed ideas of macro-nonsense, due to complementary micro-rigor beliefs. In AIS, I believe we try avoiding all these issues and rather try to

attract interesting topics. There are conditions when one asks about this very question, and the answer is: as stated above.

While the series of issues in this book examines a wide variety of topics, these can be logically classified into research groups, with related topical issues. In some interesting future extensions, for example, arguments about the nature and role of issues in affecting outcomes can be developed and justified as part of AIS building. This book overall is a display of plurality in AIS research, which offers many benefits, however. And this is why this specific research volume is needed: it presents contributions to AIS research from researchers in the area. I also find this of significant importance and again I certainly encourage researches to further develop AIS-theoretical arguments in their future research.

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Trends in Accounting Information Systems

Daniela Mancini, Eddy H. J. Vaassen and Renata Paola Dameri

1 Introduction

Most of the contents of this book is based on a selection of the research works presented at the track entitled ‘Accounting Information Systems’ of the 2012 Annual Conference of the Italian Chapter of AIS (ItAIS), which was held in Rome, Italy, in September 2012. The aim of the track was to sketch a clear picture of the current state of Accounting Information Systems (AIS) research in a broad sense, including design, acceptance and reliance, value added, decision making, inter-organizational links, and process improvements. In particular, despite the fact that accounting information systems are often considered the instrument by default for accounting automation the track starts from a wide definition of the accounting information system, as a complex system composed of a mix of strictly interrelated elements (such as data, information, human resources, IT tools, accounting models and procedures), and basically involved in collecting, classifying, elaborating, recording, storing accounting data. The aim of the track was to give evidence to the strategic role of the accounting information system in decision processes within and between companies and to define instruments and practices for identifying and evaluating this strategic role. The message that comes across is that the accounting information system has grown into a powerful strategic tool to support

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decision-making inside companies, top management's decision processes, and outside companies, stakeholders' decision processes.

The book is a quest for evidence regarding this observation by examining a wide range of current issues ranging from theory development in AIS to practical applications of accounting information systems. In particular it focuses on themes of growing interest in the realm of XBRL and Financial Reporting, Management Information Systems in specific contexts, IT/IS Audit and IT/IS Compliance, integration of Accounting and Management Information Systems and so on.

The volume contains 16 research works that were accepted at the Conference after a double-blind review. They adopt a different theoretical approach to investigate accounting information systems and the relationship among accounting models, information technology, reporting tools, organizational aspects and companies' behaviour. The contributions also adopt different research methodologies including single and multiple cases study, content analysis, surveys and theory development. In addition to these articles, the book contains two research works selected from the same track belonging to the 2012 European Conference of Information Systems (ECIS) and three invited research works concerning specific themes of interest.

2 The Strategic Role of the Accounting Information System: A Two-Way Relationship

Even if accounting information systems are by now mature tools, they are not only essential instruments for managing the company, but also important enablers of business innovation [1]. Indeed, they have always been evolving during time and there is still a long way to go, for the best alignment between accounting information systems and the business. The evolution of accounting information systems is like a broken line, showing various trend breaches resulting from disruptive changes in a wide variety of societal and environmental factors [2]. However, there are three factors that may be considered the main antecedents of accounting information system changes, i.e.:

- Technology;
- Management practices and models;
- Accounting rules.

The relation between accounting information systems and these factors has been the object of many studies in recent years. It is considered a complex relationship where accounting information systems sometimes are the dependent variable and sometimes the independent variable.

A large part of the studies consider technology as the main variable that has an impact on management practices and models, accounting rules and on the other components of the accounting information system. For example, the Internet deeply influenced accounting information systems, and indeed web technology has

had an impact both on how an accounting information system is built, and on how it is used. Nowadays it is difficult to imagine how databases and the access to them are organised without having access to the Internet. And this is not just because of standardized business reporting as enabled by XBRL but also because of the emergence of cloud computing. Also the migration from a hierarchical organisational model towards a process oriented model has been driven by ERP systems, because of the new technology and the new way of designing accounting software.

In the last decades the word ‘strategic’ has become associated with the accounting information system as being synonymous to organizational innovation, efficiency, reliability of information, and relevance of information for internal and external stakeholders. For many years it seemed that information and communication technology was the main driver of the strategic role of the accounting information system and its evolution.

In recent years scholars seem to want to enhance their knowledge of such relations and stress the idea that maybe, to clearly understand the evolution process of accounting information systems, it is necessary to start from a point of view that considers a two-way and interdependent relationship between accounting information systems, technology, accounting rules, accounting practices and models. This is a truly holistic view that provides a much better match with control models of contemporary organizations than the good old cybernetic view.

In this sense accounting information systems influence the organizational architecture of the company, so that the interaction between accounting information systems and the business indeed becomes deep and, for example, the relation between accounting information systems and ERP can be read as the organizational trends that drive the ERP structure. Similarly, some practices and techniques in management control, like Activity Based Costing or the Balanced Scorecard, both influence the technology employed and are supported by accounting information systems. In this context, ‘strategic’ means searching new ways to combine information and read economic and competitive events, using technology as a fundamental tool to trigger innovation, and as an important support for internal decision making processes. Several studies try to understand how it is possible to implement performance management models through information systems tools, how it is possible to reach more complete levels of integration between different tools, and how the alignment between information systems and the business really takes place.

We firmly believe that the meaning of ‘strategic’ refers to another critical and two-ways relationship. The International Accounting Standards reliability strongly have been determining IT governance practices and auditing standards. On the other hand, accounting information systems have been having a tremendous impact on business architectures, financial disclosures and data quality [3].

Financial disclosure is really the product of the accounting information system, therefore, the governance, compliance and control of accounting information system software, but also of accounting information system management processes, are crucial to grant the complete reliability of financial information [4] not only inside the company but also outside, among different stakeholder.

Data quality is one of the key issues in managing complex and global companies in a fast changing, heterogeneous world with often—what is by now almost commonplace—big data. To be able to collect in real time, select, process and distribute data really necessitates a profound knowledge of the company as well as external consensus rooted in transparency. In this sense ‘strategic’ means the ability of the accounting information system, as an integrated system, to satisfy external information needs for decision making and to ensure the required levels of transparency, accountability and disclosure [5].

The chapters submitted to the conference and the invited chapters as collected in this book, provide a more comprehensive view on the concept of ‘strategic’ related to the accounting information system.

Even if the accounting information system is a mature tool, it is nevertheless always in evolution. The main reason is that the accounting information system is nowadays an integrated, company-wide information system. Hence, all the changes regarding the company and the economic environment have an impact on it. Even if the applicable accounting rules and management practices are important sources of innovation in accounting information systems, the main change driver is the globally competitive arena. However, the scope of any accounting information system and its pervasive nature with respect to the business processes influences the diversity and heterogeneity of AIS research.

However, some topics are more critical than others and—surprisingly—they are not so different compared to ten years ago. Looking at the chapters submitted for the AIS track at the ItAIS Conference, we may find that some problems such as accounting data quality, accounting information system integration, alignment between the accounting information system and the business or using the accounting information system for effective management control have always been the hot spots for this subject.

To understand how research could be useful to face and perhaps solve these long term issues affecting accounting information system effectiveness in business, we should deepen our quest by trying to synthesize several contributions to build a comprehensive model that is able to drive further research. The main contribution of this chapter is to define a panorama of the main problems and the suggested solutions regarding the effective use of accounting information systems in financial disclosure, management control and IT/business alignment.

3 The Quality of Financial Data: Excellence in Accounting Information System Auditing and Control

The role of the accounting information system in producing reliable financial information has become increasingly important after the infamous and well-debated financial scandals all over the world. Indeed, even if the work of auditors had already been based on accounting information systems, the need to control the accounting information system for its own sake was not on the corporate agenda

before these scandals. As these financial scandals negatively impacted the financial markets and the trust in companies' financial statements Stock Exchange Committees in most industrialized countries worked hard to restore trust. The Sarbanes–Oxley act (SOX) is the most important law regarding the reliability of financial disclosure. Subsequent studies have argued that SOX has severe implications for IT governance and hence for companies' accounting information systems [6].

The strong link between financial data, information systems and quality of earnings is at the basis of the IT Governance and Compliance discipline, which aims to define secure processes and organisational architectures as the environment of accounting information systems, to govern the reliability of the processed financial data.

However, current IT Governance practices have been more and more influenced by the professional standards issued by national or international associations such as the IT Governance institute, which has issued the most widespread standard for IT governance, COBIT. Companies had been convinced that adapting their IT processes and practices to COBIT was the right way to obtain reliable, controllable and secure accounting information systems and that this practice merely required a textbook implementation of COBIT. However, any COBIT implementation is one of the most problematic aspects of controlling accounting information systems. It is therefore not a surprise that, even after one decade, many chapters still focus on this issue. Several aspects have been neglected, including risk assessment, compliance with standards such as COBIT, the cost of IT governance, and effectiveness of these practices [7]. The (positive or negative) impact on the IT governance stakeholders—including the company itself, its management, and the financial markets—is far from measurable. Several doubts may come across from the compliance imperative. In the first years after its release COBIT was considered the right tool to mirror the spirit of the law with respect to accounting information system reliability, security, and controllability, nowadays some unanswered questions have become increasingly urgent. For example, even if COBIT and COSO adoption positively impact audit quality, the real effects on accounting information system reliability, security and controllability are not demonstrated, the gap between conceptual models for audit and control, and their effective implementation is still wide; and the implementation cost is not justified by the improvements in reliability, security and controllability of the accounting information system, even if some controls are enforced by legislation [8, 9].

There is a substantial body of research that opens new ways to reinforce the usefulness of IT governance and to fill the gap between the implementation of professional standards and the definition of a firm-specific IT governance framework. This research focuses on the importance to align accounting information system architectures, IT governance and IT auditing practices; the use of innovative evaluation models to assess the impact of accounting information system audit and control on data quality, both for internal and external use; and compliance practices to enhance awareness of accounting information systems weaknesses.

To gain higher returns from accounting information systems as enablers of compliance, a better alignment between the accounting information system and the

business is needed. Indeed, if compliance is not seen as a duty, but as an opportunity [10], several interesting aspects emerge. For example, the focus on data quality reliability is important not only for external disclosure, but also to support better decision-making. The enhanced organisation of IT management processes is not just a source of data reliability, but also of a more efficient and effective information systems planning. The compliance cost could be compared with benefits deriving from a higher awareness of accounting information system architecture and functioning, thanks to a careful business and accounting process design and control. However, assessment methods and criteria are inadequate to support this type of measurement. Moreover, also the cooperation between the CFO and CIO regarding accounting information systems compliance aimed at value added of accounting processes and data quality is not so strong. As long as accounting information system compliance is only seen as a duty, it is difficult to gain more value from these practices.

For the same reasons, there is a large gap between accounting information system auditing and financial data quality between large and small and medium enterprises (SMEs). Indeed, for the large companies, often listed on the stock exchange, accounting information system control and auditing is a legal duty. Therefore, companies implement audit and control systems and then they try to gain higher returns thus enlarging the scope of accounting information system compliance as in, for example, improving data quality or accounting process efficiency and reliability. On the other side, SMEs are not forced to adopt accounting information system auditing practices. As a result they are not very keen on implementing accounting information system control activities. This expands the differences between data quality in large companies and in SMEs and creates two classes of accounting information systems, the “good” ones, audited and improved, looking for the best quality and returns; and the “bad” ones, unaudited and not supported by any quality program [11].

However, if also SMEs were able to link accounting information system audit and control with more effective managerial control and a more efficient business process organisation, they would become more interested in applying accounting information system control and compliance, to get these improved results [12].

Finally, it seems clear that accounting information systems play a central role in the collection and disclosure of information to support internal and external decision-making. This implies that relevance can be studied from different points of view: not just the CFO, CIO or CEO perspectives but also, for example:

1. Audit firms’ perspectives, when the object is XBRL and financial disclosure as in the work of La Rosa and Caserio, and Azzali and Mazza;
2. Citizens’ perspectives, when the object is public administration and its transparency and performance disclosure, as in the work of Lepore and Pisano, and De Angelis and Guerra;
3. Stakeholders’ perspective, when the object is environmental reporting as in the work of Garzella and Fiorentino.

As a consequence accounting information systems have relevant connections with internal control over financial reporting in order to assure financial information reliability as in the work of Ianiello, Mainardi, Rossi and Vasarhelyi.

4 Accounting Information Systems and Management Control

The use of accounting information systems in companies is not only aimed at accounting, but also at improving management control. Firstly, the architectural model of an accounting information system integrates both financial and management accounting, and secondly links management accounting to management control since management accounting information is used for management control purposes. Reported earnings, for example, are used for performance-based pay. However, this integration does not go without obstacles for several reasons, including the impact of technology, the rigidity of accounting information systems, and the roles of accountants and managers [13].

Accounting information systems are often regarded as machines able to transform input into pre-defined output in high volumes. As such accounting information systems are the cause as well as the solution to the “informational overload” problem. Indeed, accounting information systems provide lots of information, but they also process data, by organising, retrieving and selecting to meet the manager’s information needs.

A simplified model of an accounting information system shows the system organised in three levels. At the basic level, there are business processes that produce elementary data regarding simple business operations, collected by the operational accounting system. At the intermediate level there is the financial accounting system where elementary data are (re-)organised, to respond to the financial accounting standards and to produce the financial statements and some other financial information. At the top level there is the management accounting system where both operational and financial data are processed to produce information and perhaps knowledge to support managerial and strategic decisions [14].

If we examine the integration between the first two levels—operational and financial accounting—we find that this integration nowadays is often embedded in ERP systems, both for large companies and for SMEs. Indeed, accounting and process integration is just one of the main goals of ERP. However, it is not enough to ensure the real integration between accounting information, its use and an integrated vision on both operational and financial aspects of the business. The role of information and communication technology (IT) has been crucial to develop the informational integration within ERP systems, yet the accounting system has often been designed far from the real needs and visions of managers, but based on theoretical best practices instead. The formal implementation of process control systems is not enough to copy best practices as derived from process monitoring.

Moreover, data and information produced by the systems to support operational decisions are sometimes not aligned with the real information needs of process owners. Therefore, despite the operational and accounting integration in ERP systems being a traditional research field it still offers various strands for further research to reach more awareness of its role and importance for business management [15].

The top level integration between financial and management accounting has a wider gap, because management control is less formal and schematic than operational accounting or bookkeeping if you will. Management accounting, in fact, is related to management practices, which are deemed to change over time attempting to align with competitive scenarios. In addition, each company has different needs and it applies specific management styles, accounting models and instruments to control the company objective achievement. Moreover, technical characteristics of the accounting information system may not be suitable to implement the required advanced managerial accounting systems, such as using artificial intelligence, statistical instruments or qualitative data. In all these cases, IT applications are externally integrated with accounting information systems, to enable data retrieval [16].

Managerial accounting's most interesting trend is the utilization of advanced managerial practices, such as Activity Based Costing and Management, or the Balanced Scorecard. As previously mentioned the accounting information system becomes an efficient and effective instrument enable large ('big') data quantity processing when the design of accounting models and instruments and their implementation directly involves the users, i.e. top management.

Top management engagement result in a system they have customized to their use and for their benefit while simultaneously being trained on its use.

The role and benefit of top management engagement has been widely studied, yet still it has so many advances to make!

It is possible to identify several streams of research concerning the relationship between accounting information systems and management information systems that need further contributions, including:

1. The integration between accounting measures and strategic tools such as knowledge management tools, as in the work of Del Gobbo; integration between accounting information systems and the Balanced Scorecard tool as in the work of Candiotto and Gandini;
2. The need to explore the boundaries between accounting and management information systems as in the work of Inghirami;
3. The use of accounting data to simulate and predict the future as in the work of Franceschetti, Koschtial and Felden;
4. The need to search different and more efficient database schemes to elaborate and archive accounting data in order to meet decision-making needs and technical optimization as in the work of Caserio, Marchi and Pulcini.

5 Accounting Information Systems and Business Alignment: An Evergreen in Information Systems Research

The alignment between accounting information systems and the business is an old, yet not outdated topic. Before the spread of integrated accounting information systems like ERPs, accounting practices were largely independent from the business, the chart of accounts was the exception as it was typically adapted to the specific business. With the introduction of ERP systems, a new opportunity in accounting information system enhancement was established: the bidirectional relationship between the ERP and business organization architectures [17].

Since Davenport's work "Putting the enterprise into the Enterprise System" [18] until today, the question "what drives what?" remains relevant: is it the ERP system that drives the enterprise transformation, or the enterprise evolution towards the process-based model that forces accounting information systems to change and integrate?

Towards the end of the 90' business organizations were challenged to improve their efficiency in order to gain customer satisfaction. Porter's suggested value chain model was the best solution to realize a flatter organization, reducing time to market and lowering transformation cost. At the same time, the increasing database capabilities and the development of Internet-based applications offered the solution of accounting information systems integrated in a single repository accessible anywhere and anytime. The same objectives and conceptual model were at the base of enterprise information systems [19].

Although, it is not possible—15 years after—to state if Davenport was right because each business case has its own specificity. However, a fair statement is that IT and business do not anymore have the same goals.

While ERP needs standardization and integration, business requires agility and flexibility, to face globalisation and adapt to the fast changing economy.

The IT governance discipline shows that the choice between centralised or federated IT models depends on a number of factors mainly related to the economic challenges. What are the implications for accounting information systems? Are they suitable to adapt to the new flexibility request, or are they tied by their own architecture? The answer to the above queries could drive the design of new accounting information system conceptual models thus providing one of the most interesting research fields [20].

The following works aim to provide new and innovative views on the relation among accounting information systems, business models and information needs. The ultimate goal is to find:

1. Balance between standardized accounting software and customized solutions as in the work of Corsi, Trucco and Rizzo; the work of Lazzini and Iacoviello; and in the work of Rupo;

2. The necessary enhancements needed to accounting measures when operating in a business network context as in the work of Di Vaio and D'Amore;
3. The performance indicator system that is capable of measuring the impact of e-invoicing on companies as in the work of Bellini, D'Ascenzo, Ghi, Spagnoli and Traversi.

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Are Auditors Interested in XBRL?

A Qualitative Survey of Big Auditing Firms in Italy

Fabio La Rosa and Carlo Caserio

Abstract Although academics and scholars have called attention to the opportunities and challenges of eXtensive Business Reporting Language (XBRL), new empirical evidence undermines academic assumptions about XBRL's easy acceptance and widespread use by auditing professionals working in the field. This study examines whether independent auditors in Italy are really convinced about the utility and practicality of XBRL in their work. What is proposed here is a preliminary theoretical framework for surveying auditors' interest in XBRL. Electronic questionnaires and semi-structured interviews were used to survey Italian auditors' interest and test the proposed framework. Data analysis was structured by adopting a multiple case approach. Despite the mandatory requirement for Italian unlisted companies to report financial statements in XBRL, the independent auditors' knowledge about XBRL remains quite low. As a result of the survey, a set of unexpected but clear-cut attitudes emerged to explain auditors' limited interest in XBRL.

Keywords XBRL • Independent auditor • Multiple case study • Unlisted companies • Italy

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1 Introduction

Scholars interested in the XBRL format have focused attention on its influence for different groups of stakeholders who might benefit from XBRL adoption [1, 2]. In particular, XBRL is thought to facilitate communication among market players and to improve the quality of information within corporate reports [3]. Meaningful substance and open communication support corporate transparency, which in turn allows stakeholder decisions to rest on unassailable facts [4].

However, since interactive data should also meet the expectations of investors for reliability and accuracy (e.g., SEC, 2009), these data must be assured or audited for accuracy, consistency and reliability [5–11]. In this sense, it is recognized that XBRL disclosures will need some degree of independent assurance to achieve acceptance within the investor community, since the provision of an independent opinion on the reliability and accuracy of filings would boost investor trust [12]. As pointed out by Trites [13], evidence shows that some users, such as analysts, really do ask for assurance on the data. Empirical evidence shows that filings by firms in the first round of submission contained errors and, although appearing in smaller quantity in subsequent rounds, errors persist [6, 14–17].

Not all firms are involved in the same manner in this process. For example, unlisted companies adopting XBRL probably pay less attention to the above-mentioned advantages relating to the market. They might not view XBRL as an important tool for both investors and analysts and they might not perceive any need for the assurance of corporate documents. Nonetheless, even XBRL data produced by unlisted firms can be inaccurate.

Because the auditing of XBRL reports remains voluntary, companies of all size might ask for an assurance service on XBRL instance documents [18, 19]. By doing so, companies might check whether their instance documents provide a true representation of the electronic document and, as a result, really do provide an accurate picture of the business itself.

From a theoretical point of view, auditors should consider themselves one of the primary stakeholders who ought to become more involved. Moreover, when filings become mandatory, the degree of involvement and the level of attention paid by auditors ought to be greater, as compared to the voluntary context. A number of reasons have been advanced in support of a greater role for auditing in the XBRL era. For example, XBRL has been considered a means for improving corporate governance [20, 21] and auditing, as a part of the corporate governance framework, could provide noteworthy support in this role. Scholars interested in XBRL have explored how its implementation might sustain the practice of continuous assurance/auditing [22, 23]. Although the impact of XBRL on auditing is still being discussed, many contributions have enthusiastically highlighted potential advantages for auditors, such as automatic validation of calculated numbers or compliance with disclosure checklists and, generally speaking, the fact that auditing will become easier, because it becomes possible to support the auditing process by computers.

While the above-mentioned studies stemming from the XBRL format have stressed *theoretical opportunities and challenges* for the auditing profession, less attention has been paid to how and why XBRL may *actually and practically interest* auditors.

Empirical evidence indicates the expertise of independent auditors in XBRL assurance procedures is not as high as it should be. In their field investigation, Janvrin and No [24] found that most respondents reported their auditors were not interested in auditing their XBRL-related documents. An Institute of Internal Auditors survey of over 200 internal audit executives found that over 50 % were unfamiliar with XBRL. At the same, 90 % were interested in learning more about their role [25]. Pinsker's [26] sample results indicated a lack of knowledge and experience in XBRL auditing and accounting. Dunne et al. [2] studied the extent to which corporate stakeholders in the UK were familiar with XBRL technology. They found that auditors, as key players in companies for the adoption of XBRL, are beginning to realize that XBRL is something about which they need to know more, especially since the implications for the audit and assurance of XBRL financial statements are still not clear [13].

As a result, a gap exists between scholars, who show potentially high benefits of XBRL for the auditing practice, and professional auditors, who do not seem interested in XBRL at all.

This chapter aims to fill this gap by surveying the interest in XBRL within large Italian auditing firms. The Italian scenario is interesting for such a survey because: (a) Italy has a permanent XBRL jurisdiction; (b) XBRL is mandatory for unlisted companies; (c) a number of unlisted companies voluntarily ask for a financial auditing performed by a big auditing firm, even though they may address the issue to the internal Board of Statutory Auditors; (d) big Italian auditing firms have played and keep playing a significant role in improving financial statements of Italian firms and in offering other audit services¹; (e) larger auditing firms have a good reputation in their clients' opinion [27].

While many countries around the world require public companies to adopt IFRS (International Financial Reporting Standards) and XBRL-tagged reporting formats, Italy is one of the few countries that introduced the adoption of XBRL beginning with unlisted companies' financial statements. Since the introduction of the PMD (Prime Minister Decree of December 10, 2008), the implementation of the XBRL format in Italy became mandatory, but only for unlisted companies that were not compliant with IFRS standards in the preparation of their financial statements (limited to balance sheet and income statements, excluding notes).

¹ Actually, in Italy the demand for voluntary audit services addressed to the big auditing firms has registered a significant decrease in recent years (from about 43 % in 2006 to about 32 % in 2010). However, this results both from the switch to mandatory audit services previously only voluntary, and the general financial crisis [28]. Since non-audit services represent one of the most dangerous threats to the independence of auditors, big auditing firms may also have decided to considerably reduce this business, especially when the *Parmalat* scandal obliged regulators to make more stringent requirements in order to guarantee auditors' independence.

At this time, Italian filers are not required to obtain a third party assurance on XBRL instance documents. The main reason for this, as in other places like the US, may well be to encourage filers to comply without forcing them to incur the additional expense of more auditing. However, since XBRL reporting is now mandatory in Italy, independent auditors must now pay closer attention than they would have in the case of voluntary reporting.

Because we anticipated—according to the empirical evidence—that auditors ignored the topic, we approached the issue by trying to understand why Italian independent auditors were not interested in XBRL (not even within the special context of mandatory XBRL financial statement reporting) in order to evaluate which motivations were the most relevant in accounting for the poor attention paid to XBRL. To do this we first propose and then test a framework of four complementary perspectives (regulatory, economic, technical/procedural, cultural) supported by a set of four theories: Institutional Isomorphism, Cost-Benefit/Utility Analysis, Technology Acceptance Model (TAM), and Diffusion of Innovations. The usage of TAM in a voluntary context (such as the Voluntary Filing Program—VFP) has been criticized because various reasons (other than the deterministic variables that comprise the technology adoption models) may explain XBRL adoption by filers [29]. Therefore, in order to investigate auditors' interest in XBRL we extended our framework by including other theories looking at regulatory, economic and behavioural perspectives.

This study contributes to the existing literature by surveying interest in XBRL not from the XBRL filer' perspective as many scholars have done so far, but from an external auditors' perspective in order to provide for some answers to the “interest gap” existing between scholars and academics on one side, and professional auditors on the other side, as recently noticed [24]. This study also looks at unlisted companies, while a number of previous contributions paid attention only to listed or public companies. Moreover, previous studies on XBRL assurance were based on partial approaches, e.g., focused on technical or cost perspectives, while this chapter aims to offer a more comprehensive approach to the issue. Lastly, while many studies have addressed the issue of XBRL adoption in the voluntary setting (e.g., [30]), we conducted our survey in the mandatory setting.

The paper, aiming to shed light on the auditors' point of view, is structured as follows: [Sect. 2](#) briefly describes a review of the literature focused on XBRL assurance issues potentially involving independent auditors; [Sect. 3](#) provides a research framework to formulate fresh perspectives by which auditors might be attracted to XBRL; [Sect. 4](#) describes the research method and presents results stemming from a two-step qualitative investigation; finally, the last section contains conclusions and practical implications for the auditing profession.

2 Background: Should Independent Auditors be Interested in an XBRL Assurance?

Alles et al. [22] show that the key driver of “continuous assurance” is the demand for it. At first glance, the main reason driving auditors’ involvement with XBRL should be related to an assurance demand voluntarily arising from firms that adopt XBRL. However, this demand for XBRL assurance depends on the voluntary or mandatory implementation context.

Within a voluntary adoption context, XBRL has been thought of as a way for firms to signal their legitimacy in the market, their commitment to transparency [7, 31] and in order to obtain some advantages as first movers. For example, Tan and Shon [32] show that firms adopting a VFP tend to be more profitable than non-XBRL filing firms, and that VFP firms experience an increase in analyst tracking and trading activity in their stocks. In this context, firms may ask for an assurance service in order to give greater credibility to the filings.

However, as XBRL adoption becomes mandatory, financial behaviour is likely to even out, and incentives will decrease for first movers and those firms wishing to acquire legitimacy. As a result of the standardization of data thanks to XBRL, the interest in and the need for an XBRL assurance service could decline, and for unlisted companies such an interest would be even lower. Consequently, the role for the external auditing firm as the source of assurance for XBRL filings cannot be taken for granted [33], so that the question of whether XBRL documents need to be assured by independent auditors still remains controversial and unsettled [21, 29].

Scholars suggested a number of theoretical and empirical reasons for supporting an assurance service, even for unlisted firms. Theoretical contributions, especially based on a normative literature, argue that when XBRL usage proliferates, as in the mandatory scenario, it is likely that user demand for assurance will also increase [13]. Similarly, Alles and Gray [33] predict that if the XBRL filing becomes the official filing, the auditors interest in assuring that there are not material errors in the XBRL filing increases. Thus, also unlisted companies may feel the desire to engage an auditing firm to help them in assessing the completeness, accuracy, consistency and other relevant assertions of XBRL-tagged data.

Smaller firms and unlisted companies may also find mandatory adoption of XBRL difficult due to their limited experience with IT tools. General IT experience is not sufficient to rapidly master new and complex programs like XBRL, so that the conversion of financial statements into the XBRL format may be defective. As a result, data quality will drop. For instance, according to Debreceeny et al. [17], a key aspect of data quality is the accuracy of the mathematical relationships underlying the XBRL taxonomy as implemented in the instance document. Besides, the absence of a requirement for third-party assurance and the limitation of legal liability regarding inaccuracies reduces the incentive to provide error-free XBRL documents [16].

Actually, looking now at the empirical evidence, much research on XBRL has emphasized the large number of errors, both of type and frequency, made by

companies participating in the XBRL program. Boritz and No [6, 7] found a variety of errors in filings, such as differences between the XBRL instance document and the official filing and redundant extensions. Srivastava and Kogan [10] distinguish among possible data deficiencies in the XBRL instance document, possible deficiencies of the mark-up in the XBRL instance document, and possible deficiencies in meta-data external to XBRL instance document. Debreceeny et al. [17] found calculation errors (e.g., more members of a calculation relationship were either missing or extraneous), errors in the application of negative values and errors involving extensions. Bartley et al. [16] detected several errors and inconsistencies in the voluntary filings of 2006, including missing financial statement elements, incorrect amounts, incorrect signs, duplicate elements, financial statement concepts not tagged with the appropriate elements, and inaccuracies in the display of the financial statements. Given all these possible errors, the users of XBRL are likely to demand assurance of XBRL instance documents.

Regarding the frequency of errors, although initial inaccuracies and errors in voluntary filings have decreased, thus allowing the quality of filings to improve significantly [6, 14, 16] a significant number of errors and inconsistencies are still found. Markelevich, Shaw and Weihs [34] found a large number of inconsistencies in Israeli firms' XBRL financial statements; they suspect it is due to the lack of importance placed by staff on the translation of data for XBRL entry. Debreceeny et al. [17] counter-intuitively found that the number of errors was higher for companies that had previously participated in the VFP, probably because of the filers' low experience with XBRL itself. Therefore, an XBRL assurance process could be useful, especially after initial adoption. Thus, while improvements in the XBRL standard and related technology will reduce certain types of error, others, due to insufficient training and inexperience, will persist [16].

However, we should also be aware of what kind of review an XBRL financial statement implies and what result or goal that process aims to achieve. As to process, Srivastava and Kogan [10] suggest the need for a conceptual framework composed of a set of assertions, similar to the management assertions for financial audits, in order to avoid an ad hoc and inconsistent assurance process for XBRL instance documents. According to Boritz and No [6] and Alles and Gray [33] assurance may be needed not on the translation of the paper documents into XBRL, but directly on the process used to prepare the information for XBRL. This assurance may focus on the fair presentation of information in accordance with accounting principles (i.e., completely and accurately reflecting the business facts), the compliance of XBRL documents with the relevant XBRL specifications and regulatory requirements, and the effectiveness of the XBRL generating process.

Moreover, the nature of the auditing process will depend on the use of XBRL. For example, Trites [13] argues that if XBRL is employed to supplement the traditional reporting process, a specific standard is needed to deal with those XBRL filings. On the other hand, where XBRL is used to prepare primary financial statements, more fundamental changes on the standards are required.

Concerning the final result of the auditing or assurance process of an XBRL financial statement, it should result in an opinion as to whether the instance

document is a true representation of the standard format document (i.e., ASCII or HTML). For instance, Eccles and Krzus [9] think of electronic reports as “composed of a much more granular level of information, with specific tags for each individual disclosure item. The audit firm will have to verify the accuracy of these individual tags while still giving an opinion that the financial statements are - « fairly presented taken as a whole »”.

In a broader sense, XBRL assurance will also depend on the approach adopted by companies for preparing XBRL documents. A mandatory approach to financial reporting—including its (digital) format and not merely its accounting standards—may be pursued in a *formal* way, simply in order to guarantee it is in accord with the applicable rules and legislation. To ensure the success of the interactive data program as well as the distribution worldwide of its new digital format, the *substantial* implementation of XBRL is vital for both listed public companies and unlisted companies.

According to Taylor and Dzurainin [35], companies preparing for the requirements of mandatory XBRL financial reporting can take several alternative approaches, such as by converting their external financial statements into XBRL using the company’s existing reporting format; by using an XBRL mapping and instance creation application; by outsourcing the work; by building the XBRL conversion at the reporting applications level, thus using XBRL for both internal and external reporting; or by implementing XBRL in the business reporting supply chain. Consequently, auditing approaches will differ. For example, Boritz and No [7] report the case of assurance service for the United Technologies Corporation’s (UTC) instance document performed by PricewaterhouseCoopers [36, 37], although it is not clear which auditing approach was adopted.

Other lexical and conceptual issues should be faced when an XBRL assurance process has to be implemented. Plumlee and Plumlee [8] argue that before auditors start using statistical techniques to audit XBRL instance documents, the levels of tolerable error and tolerable deviation need to be clarified, because the traditional concept of financial statement materiality is not directly applicable to XBRL documents. Similarly, Srivastava [38] poses the question about what constitutes a complete and accurate or “true representation” of the financial statements (See Table 1).

3 Research Question and Proposal for a Framework to Study Auditors’ Involvement with XBRL

The above-mentioned contributions, and in particular the efforts made by some academics to build detailed XBRL assurance frameworks, seem to warrant auditors involvement with XBRL assurance although they paradoxically and strongly contrast with the empirical surveys (e.g., [2, 24, 26]) showing scant or null interest among auditors about XBRL.

Table 1 A literature review on potential reasons for auditors' involvement with XBRL assurance in terms of new advantages and challenges

Research area	Content and aims	References
Auditing	Facilitate "continuous auditing" or "continuous assurance"	Alles et al. [22], Pathak Sriram [23]
Corporate governance	Improve corporate governance	Du and Roohani [20], Alles and Piechocki [21]
IT experience	Errors due to insufficient training and inexperience.	Bartley et al. [16]
Type of errors	Differences between instance document and the official filing and redundant extensions; data deficiencies in the instance document, deficiencies of the mark-up in the instance document, deficiencies in meta-data external to instance document; missing FS elements, incorrect amounts, incorrect signs, duplicate elements, FS concepts not tagged with the appropriate elements, inaccuracies in the display of the FS; calculation errors, errors in the application of negative values and errors involving extensions	Boritz and No [6, 7], Srivastava and Kogan [10], Boritz and No [16], Debreceeny et al. [17]
Frequency of errors	High number of errors and inconsistencies still found after initial adoption; large number of inconsistencies; number of errors higher for companies that had previously participated in the VFP	Boritz and No [6], Bovee et al. [14], Bartley [16], Debreceeny et al. [17], Markelevich et al. [34]
Assurance process	Need of a conceptual framework and assertions; accuracy of tags; standards	Boritz and No [6], Srivastava and Kogan [10], Trites [13]
Assurance result	Financial statements are fairly presented taken as a whole; instance document is a true representation of the standard format document	Eccles and Krzus [9]
Approach for the preparation of the XBRL financial reporting	Mandatory vs. voluntary; formal vs. substantial; internal vs. external reporting; outsourcing vs. implementing XBRL in the business reporting supply chain	Trites [13], Taylor and Dzuranin [35]
Lexical and conceptual issues	Tolerable error and tolerable deviation, materiality, true representation of the FSs	Plumlee and Plumlee [8], Srivastava [38]

In light of this issue, we can state the following research question:

Why are independent auditors not interested in performing an XBRL assurance in unlisted Italian companies?

This question addresses implications for financial auditing. First, understanding reasons why auditors are not interested in XBRL is useful because it helps regulators to develop or reinforce their involvement with it stemming from those reasons. Second, analyzing motives of auditors' low interest may prevent a new "expectation gap" between what stakeholders search for in a XBRL financial statement and what professional auditors may really offer them in performing an assurance service. Third, answering to this research question may reduce the actual gap existing between scholars and independent auditors as to the interest in XBRL. Lastly, the above research question does represent a research field explicitly identified by some scholars [24].

In order to survey what motives and goals might draw auditing professionals into more involvement with XBRL issues, this and the following subsections will propose and test a framework based on the four different perspectives.

Our main hypothesis is that one or more of the following determinants contribute to the state of inattention by auditors for XBRL:

1. *Regulatory*, that is, the absence of a regulation on the XBRL auditing and assurance issues;
2. *Economic*, related to the low relevance of the profit margins which would arise from the XBRL auditing and assurance services;
3. *Procedural/technical*, given that an XBRL financial statement easily complies with the traditional format;
4. *Cultural*, in relation to the marginal value expected from XBRL assurance in the overall auditing approach.

3.1 The Regulatory Perspective

From the regulatory perspective the assurance of XBRL financial statements should be required by law. Regulatory intervention is usually prompted in response to a new round of financial scandals or the need to engage in the harmonization process within the EU. This recently happened with Directive 2003/51/EC, which calls for an "opinion concerning the consistency or otherwise of the annual report with the annual accounts for the same financial year".

However, governments and regulatory agencies routinely play a key role in the updating of rules and the assimilation of new technologies. New information technologies and, in particular, XBRL are valued in themselves for facilitating the introduction of new regulatory frameworks, such as IFRS and Solvency II [39]. Finally, in order to reinforce this loop "regulation-IT-regulation" and to guarantee continuous compliance with the law, regulation may also develop an XBRL financial statement assurance service provided by independent auditors.

Once an XBRL assurance service is required by law, auditor involvement may follow to the *Institutional Isomorphism Theory*. Institutional isomorphism emphasizes that organizations do not only compete for resources, but also for institutional legitimacy. DiMaggio and Powell [40] distinguish three mechanisms of institutional isomorphic change: coercive isomorphism, mimetic isomorphism, and normative isomorphism. Depending on the manner XBRL assurance would be regulated by law, either of the above kinds of isomorphism may be manifest.

In particular, strong and formal regulation may produce effects in terms of *coercive isomorphism*, that is auditing firms would be obliged to pay attention to XBRL and to learn how to perform an assurance on XBRL-related documents as a consequence of the mandatory auditing demand stemming from companies.

However, regulation should also offer a very clear definition of the XBRL assurance or auditing process, as well as make clear the legal liability of auditors. For example, in the field investigation performed by Janvrin and No [24] two respondents suggested that auditors' lack of interest in assuring the XBRL process was due to legal liability concerns. Besides, a supervisory board should be established to control the process and penalize abuses. If this were not be the case, an informal and not well structured regulation on XBRL assurance might lead to uncertainty. In turn, ambiguous goals and poorly understood technologies are powerful incentives for imitation and may produce a sort of *mimetic isomorphism*, where auditing firms will tend to offer the same assurance model, probably very simple and not stringent (such as an agreed upon procedure), that is far from the high standards required to financial statement audits.

Regulation and enforcement mechanisms are crucial but somewhat removed from the business of stimulating auditor interest in XBRL. Institutional associations and pools of experts must also play a supporting role. This is central to the mission of international professional bodies, such as the IAASB and the AICPA² as well as standard setters on the local level. In Italy these are the CNDCEC (the Italian Institute of Chartered Accountants) for the issuance of local standards on auditing, and the ASSIREVI (the Italian Association of Auditing Firms), which represents independent Italian auditors. Under the influence of auditing professional networks XBRL assurance practices would be diffused rapidly across audit firms. Therefore, these firms would be likely to comply with the normative standards issued by accounting and audit associations, so generating a *normative isomorphism*.

In Italy, while a requirement for reporting financial statements in a XBRL format has existed since 2008, legislation for XBRL auditing or assurance is still lacking. Although an opportunity to introduce such legislation was made possible by Law Decree 39/2010 (see also the related Eightieth Directive on Auditing 2006/46/EC),

² For instance, in 2005, the Audit Standards Board (ASB) of the AICPA published "Attest Engagements on Financial Information Included in XBRL Instance Documents" to provide guidance to accountants providing assurance services, and the same year the Public Company Accounting Oversight Board (PCAOB) published guidance for assurance on filings under the SEC Voluntary Filing Program (VFP).

no provisions regarding XBRL have yet been adopted. As to the audit professional associations, no local standards on XBRL assurance have been released.

In summary, regulation could play a significant role to encourage the involvement of XBRL auditors. And on a parallel track, the auditing practice itself opens up a number of opportunities where its auditors can encourage additional auditing and assurance services, notwithstanding the lack of a specific legal or regulatory requirement (e.g., tax consulting). Therefore, our first proposition states:

Proposition 1 *For independent auditors to be interested in XBRL, assurance of an XBRL financial statement should be mandated by law and auditing associations should issue XBRL assurance standards.*

3.2 The Economic Perspective

Business opportunities can provide stronger motivation. Because auditing firms are private companies, profit is without a doubt the main reason for their moving into new business opportunities. In this sense, it has been stated that the decision whether to ask the auditor to provide XBRL-related assurance is essentially a cost/benefit decision based on the relative cost of the various providers of confidence [33]. From the economic perspective the *Cost-Benefit Analysis* (CBA) is here adopted as a conceptual model to evaluate the auditors' desirability of an XBRL assurance. Although CBA is an analysis of the expected balance of benefits and costs expressed in money terms, not all XBRL benefits and costs may still be estimated in those terms, so that a *Cost-Utility Analysis* (CUA) would be more appropriate at this time.

XBRL is thought to reduce the time, labour and costs of data-quality assurance services [4], by improving the access to and the analysis of financial information, thus making XBRL more useful to auditors. This may be the case of the analytical reviews performed by auditors through the interim and final phases of the auditing process.

However, some of those benefits might be offset by new or increased costs. As to the balance between costs and benefits associated with the XBRL assurance process, the literature seems to offer contradictory results. For example, Roth (2009) [41] finds that the time it took auditors to review a bank's quarterly financial information dropped from an average of 70 to 2 days. According to the IRDCEC (Italian Chartered Accountants Research Institute [42], XBRL benefits for external auditors will only come when XBRL, including XBRL-GL, is extended across the entire accounting system.

Using an IT tool such as XBRL for financial reporting purposes does not necessarily imply an IT audit-ready work setting, one stocked with extensive software tools. In fact, software validation of the instance documents cannot identify all errors in XBRL documents, such as the appropriateness of the tag or the accuracy of the value tagged [8]. Boritz and No [6] reported that software used to prepare and edit the XBRL documents was not always capable of performing

complete mathematical validation of the financial statements. Therefore, a manual approach must also be carried out to identify those errors that are undetectable by the validation software [16], thus increasing the time and cost of the XBRL assurance process. The assurance team must either possess adequate competencies in order to audit XBRL documents, or they need to hire an XBRL technical specialist to complete the process.

Adapting auditing procedures to the new digital format will involve new expenses. Although the use of the ISA 3000 for an assurance for engagements on XBRL data is considered sufficient and appropriate in the present scenario, where both paper and digital formats exist [13], Srivastava and Kogan [10] maintain that when the XBRL financial statements will be the only format, traditional audit framework will have to be revisited and merged into the statutory audit methodology.

However, according to Alles and Gray [33] the feasibility of an external auditor providing assurance of XBRL filings is a function not just of the *absolute* cost of auditing those XBRL filings, but also of two *relative* cost comparisons: (a) the cost of obtaining that externally provided XBRL assurance relative to the cost of preparing those filings; and (b) the cost of obtaining assurance on XBRL filings from an external auditor relative to the cost of doing so using internal providers of confidence. Both of them may hinder the demand of an XBRL assurance for a big auditing firm, especially for unlisted companies. In fact, the cost of preparing XBRL documents is likely to decrease after first mandate filings thus resulting in a resistance by managers to pay an external auditor more than they pay for preparing filings [33]; and the cost of obtaining assurance using internal auditors may be considerably lower relative to the cost of assurance expected from an external auditor, although a reputation issue should also be considered in demanding XBRL assurance from big auditing firms.

Therefore, within the economic perspective, the size of the company being audited also plays a significant role. Small firms can rarely pay high fees (probably even if the cost of XBRL assurance will be a fixed cost), and this is why in Italy they bill the Internal Board of Statutory Auditors for the auditing of financial statements. Small firms also rely on much simpler accounting systems, therefore business opportunities for auditing firms are more limited. Besides, mandatory XBRL adoption by unlisted companies in the preparation of the financial statements, according to the local GAAP, would not present significant challenges for the assurance process. In fact, although XBRL will require progressively more complete and complex filings by including the tagging of the detailed contents of footnotes, under the Italian GAAP, financial statements present rigid schemes and few opportunities to change items, thus reducing the extensibility offered by electronic languages. In particular, the XBRL implementation model adopted for unlisted Italian companies can be defined as *active push* [43] since companies are allowed to use a standard taxonomy without the possibility of disclosing voluntary items that are provided in PDF or other traditional formats. As a result, while a relevant distance between the IFRS Taxonomy and the financial reporting practices of listed Italian companies exists [44], the Italian GAAP Taxonomy released

for XBRL mandatory filing in Italy almost perfectly fits with financial statements from unlisted companies, although some misfits occur depending on the sector and the size of the companies [45]. This good fit clearly reduces opportunities for auditors to perform a substantial (and more profitable) assurance for their smaller clients. Therefore, it is more likely that independent auditors will try to fold the XBRL assurance cost into total audit fees.

In summary, the economic perspective, specifically the profit incentive, will in all likelihood have an impact on the nature of auditors' involvement with XBRL assurance, as well as in non-regulatory contexts; but the size and nature of those profits must be clarified. They will have to be appreciably higher, of course, than related costs. Therefore, our second proposition states:

Proposition 2 *For independent auditors to be interested in XBRL, assurance of an XBRL financial statement should be allowed sufficient profit margins, regardless of the size of the firm audited.*

3.3 The Technical/Procedural Perspective

Looking at possible changes in procedures and practice for XBRL assurance from the technical point of view, we can expect that auditor involvement implies the idea that the assurance of an XBRL financial statement does not simply mean formal compliance with the traditional format. Something more is necessary for the assurance process and of a higher complexity than might have been anticipated.

If XBRL is thought of as a duplicate of the traditional format for the financial statement, no assurance service need be performed or repeated on it and no interest in XBRL can be expected. This is not likely to be the case, however, because many scholars have made clear the substantial changes in auditing practice, such as: a new form of audit process [2]; a set of audit assertions included in a specific conceptual framework [10]; the continuous auditing cycle concept [20]; and the adoption of particular statistical techniques to audit XBRL instance documents [8].

Obviously, each of these changes implies IT concerns. While well-defined IT standards and rules on XBRL (taxonomies, link bases, etc.) do exist and an assurance activity might be performed, more attention should be paid to IT auditing issues. In this respect, the most relevant concern is the auditors' openness to accept automatic digital procedures and to invest in deeper training on IT tools. Under this perspective, the *Technology Acceptance Model* (TAM) appears to us an interesting approach for the aim of this paper. As for the regulatory perspective, where institutional isomorphism provided a behavioural explanation for auditor interest in XBRL based on their search for legitimacy, TAM may also offer a behavioural or perceptual rationale for studying auditor involvement with XBRL.

Although TAM has been developed to explain widespread rather than modest adoption of a technology, such as in the case of independent auditors, main mechanisms of that model may be helpful in order to analyze their interest in XBRL. Besides, TAM is thought to be applicable to XBRL on a conceptual level and it has been recently used by Vasarhelyi et al. [11] to examine how XBRL can affect the usefulness of financial reporting information for, among other things, data fidelity and assurance.

TAM is an information systems theory that addresses how users come to accept and use a technology. Even though a number of factors influence auditors' decision about how and when they will use it, two main determinants have been identified: (a) *perceived usefulness*, i.e., the degree to which a person believes that using a particular system would enhance his/her job performance; (b) *perceived ease-of-use* (in turn, also a source of perceived usefulness), i.e., the degree to which a person believes that using a particular system would be free from effort [46]. Therefore, TAM may allow us to consider auditors' attitudes and intentions toward XBRL, although, as stated by Bagozzi et al. [47], attitudes towards usage and intentions may be ill-formed or lacking in conviction.

Under the TAM, XBRL should have the potential to enhance auditors' job performance through the automation of formerly-manual tasks, and to enable more rapid, well-informed decision making through the same automation process. As a consequence, the same XBRL assurance should be simpler and more useful in the eyes of an auditor compared to the traditional format. However, while "usefulness" has already been outlined (e.g., automatic validation of calculated numbers, faster and more accurate analytical reviews, etc.), the "ease-of-use", and consequently the capability to provide an XBRL assurance service, will also depend on the auditors' skills.

In the digital era, new skills and greater competency are becoming critically important for auditors. They will have to widen their focus to satisfy growing stakeholder expectations [48]. In this regard, synergistic relationships between financial statements auditors and IT auditors have been examined [49, 50]; prospects for auditors with higher IT skills have been also discussed [51]. Chaveerug and Ussahawanitchakit [52], in examining the contribution of auditors with superior IT competency, found an improved ability in their audit decision making, error detection, data mining and a reduction of the audit cycle.

However, a study from Janvrin et al. [53] on the perceived relevance of IT and its effective use by auditors pointed out that auditors perceive some IT tools as of high value, but they use them infrequently. Additionally, the employment of IT specialists is low even when examining clients in complex IT settings. Likewise, according to a survey conducted by Protiviti [54], auditors need to make a better use of the CAAT (Computer Aided Audit Tools), data analysis software, and continuous auditing tools, and, furthermore, to develop a heightened awareness about IFRS and XBRL [55]. Our third proposition states:

Proposition 3 *For independent auditors to be interested in XBRL, assurance of an XBRL financial statement should not simply mean formal compliance with the traditional format; higher IT skills should be acquired.*

3.4 The Cultural Perspective

The cultural perspective within the auditing guild presents another set of “for-and-against” pressures regarding the development of an XBRL assurance service. This perspective implies a normative approach to the XBRL auditors’ involvement, i.e., this is a consequence of the idea that the assurance of an XBRL financial statement really will change the auditing profession. Under this approach, the XBRL paradigm is thought of as a new, advanced step in the history of the auditing practice, and performing an XBRL assurance is thought of as a great innovation. However, all of this requires time and a set of different means to disseminate XBRL within a social and cultural context.

In our opinion, this perspective may find a theoretical context in the *Diffusion of Innovation Theory* [56, 57]. It aims to explain how, why, and at what rate new ideas and technology spread through cultures, where diffusion is defined as the process by which an innovation is communicated through certain channels over time among the members of a social system. Hence, four main elements influence the spread of a new idea: (a) innovation, (b) communication channels, (c) time, and (d) a social system. Individuals progress through 5 stages: knowledge, persuasion, decision, implementation, and confirmation. If the innovation is adopted, it spreads via various communication channels. During communication, the idea is rarely evaluated from a scientific standpoint; rather, subjective perceptions of the innovation influence diffusion. The process occurs over time. Finally, social systems determine diffusion, norms on diffusion, roles of opinion leaders and change agents, types of innovation decisions, and innovation consequences.

If XBRL is really perceived as a great opportunity to change financial statements and consequently assurance on them, a substantial implementation of XBRL may enhance the role of independent auditors in improving financial statements’ reliability. As was expected with the adoption of IFRS (European Commission, February 2001), independent auditors can in the same way play a key role in facilitating a substantial adoption of XBRL, thus advancing the cause for broad adoption of electronic language in auditing. In particular, the wide-ranging use of XBRL for all business processes (i.e., XBRL-GL) will involve auditors at the initial stage of data preparation for the financial statements and not merely at the final stage.

A cultural perspective entails significant changes, like a highly-developed and professionally-qualified auditor profile—gained as a direct outcome of the technical/procedural experience—and a strong education for accountants who are involved in the preparation of XBRL financial statements. The support of scholars, experts and practitioners appears essential for the promotion and dissemination of

XBRL knowledge to solve auditing issues. In particular, scholars and practitioners should maintain close ties, thus helping to correct uninformed notions about the costs and benefits that come with XBRL adoption.

In U.S., the biggest auditing firms have demonstrated their interest in XBRL, in particular because of the opportunity it affords to perform quantitative analyses more efficiently and reliably [37]. Although some benefits of XBRL adoption (in terms of efficiency, comparability and standardization of financial reporting) anticipated by scholars did not materialize [30, 58], a cultural approach would allow practitioners and auditors to monitor XBRL developments and assurance applications. Academics and scholars should continue to investigate and communicate XBRL-related auditing issues. Alas, as mentioned earlier, meaningful changes in the auditing approach arise most often as a consequence of financial scandals, and not through the cultural impetus of auditors' professional organizations. Finally, our fourth proposition states:

Proposition 4 *For independent auditors to be interested in XBRL, assurance of an XBRL financial statement should really represent an innovation and it should truly change the approach to auditing.*

Figure 1 offers a framework for studying why and how auditors should be involved in the new standardized process of financial reporting. The framework is based on the above four main perspectives and related theories, and for each perspective one proposition is formulated. However, the proposition has to be tested under a few XBRL-specific assumptions, as illustrated in the previous sub-sections.

4 Testing a Framework for Auditors' Interest in XBRL: A Multiple Case Approach

4.1 Methodology

The methodology used for this research is that for a qualitative study, based on a grounded research approach, which is situated within the constructivist paradigm [59, 60]. The results arising from the application of the grounded theory are generally aimed to proposing probability statements related to the relationship between phenomena, or intended for posing conceptual hypotheses developed from empirical data [61]. According to the Glaser approach (2003) [62], this theory generally uses qualitative data and even any typology of data could be used.

According to other scholars, the grounded theory is intended as a systematic inductive approach that allows the collection and the analysis of data coming from a direct field investigation [63]. Therefore, such a research method is based on the capability of qualitative data to explain the facts observed and for this reason it is suitable for conducting analysis of data that allow to obtain a confirm or a refutation of a theory.

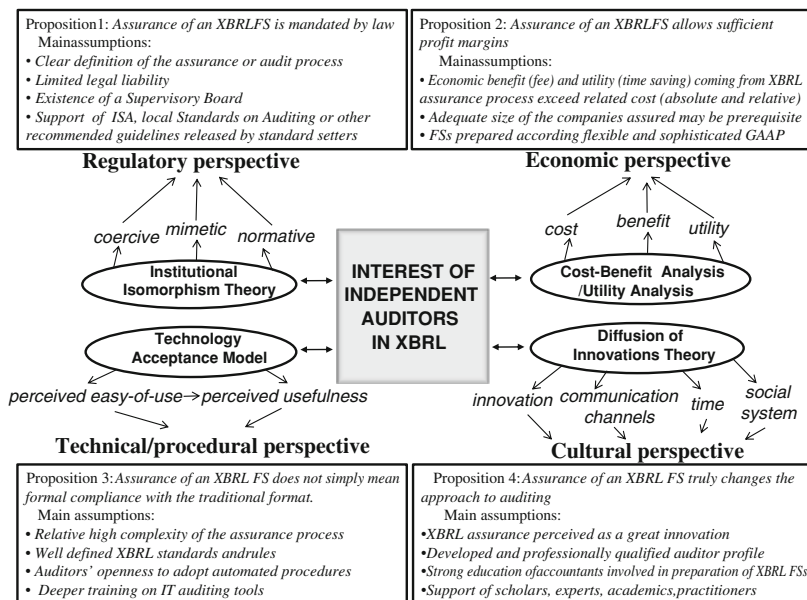


Fig. 1 A framework for independent auditors' interest in XBRL

As the aim of this research is to survey auditors interest in XBRL, we made a preliminary survey in order to insure that the low interest of auditors does not depend on poor knowledge of XBRL benefits.

Therefore, a preliminary investigation was carried out in order to gather descriptive data about the present situation of XBRL interest and to discover the perception of auditors about XBRL. To achieve such an initial investigation, a web survey method was chosen, given its suitability for reaching target groups located in widely distributed geographic areas [64].

In fact, in this step, a structured questionnaire was sent via e-mail to all the Italian auditing firms certified into the CONSOB (Italian Securities Exchange Commission) register in May 2011. A low answer rate and a lack of interest in XBRL were expected, given that similar research carried out by Dunn in the UK context revealed a very low level of interest for XBRL and a very low answer rate [2]. On this basis, the main objectives of the survey were to understand what was the auditors' interest in XBRL, in particular, whether such interest could depend on the XBRL benefits. In so doing, it has been possible to learn whether the benefits of XBRL could be a driver of the interest in XBRL. For this reason, the survey asked auditors "how" and "how much" the XBRL benefits could help them in their auditing activities. The questions were posed taking into account the main benefits of XBRL as stated in the literature. Specifically, the goals of the survey were the following:

- To achieve an overall view regarding the auditors' interest and experience on XBRL, even considering the most critical concepts of XBRL (taxonomy, instant document, link base, tag, etc.);
- To investigate whether, in view of the acknowledged benefits of XBRL suggested to auditors within the questions, the auditors' interest for XBRL is higher.

As a confirmation of the survey by Dunne et al. [2], a very low answer rate was obtained. Specially, the answers received show that the auditors are not influenced by the benefits of XBRL and thus it is possible to exclude the notion that XBRL benefits are a driver for interest in XBRL. Hence, there are surely other causes that explain the limited interest of auditors in XBRL.

For this reason, an additional, more in-depth case study analysis has to be performed in order to investigate the main causes of the low interest in XBRL.

In applying the grounded theory method, many relevant contributions pose the case study as one of the most suitable analyses to be achieved [59, 65, 66]. Specifically, a qualitative analysis of data can be obtained through a single or a multiple case study, that, according to Yin [67], belong to the same research methodology, even if they are distinguishable as distinct variants.

The main strong points of the single case study analysis are its suitability to be used with explanatory, exploratory and descriptive aims [67–69]; the possibility of its use in a multiple source of evidence [67]; its potential to generate and test theories [70, 71] when the case fits with the theoretical assumptions; its potential to confute theories, when a deviant case emerges [72, 73], or to provide previously unidentified causal mechanisms [74]; and its capability to offer a “working hypothesis” that can be compared to other cases, in order to evaluate the differences and the similarities among the cases [75]. Moreover, the case study analysis provides an important learning opportunity that can lead to the extraction of usable knowledge, especially if investigators focus intensively on critical issues [76].

However, the main risks of the case study are due to the use of insufficient information which could lead to unreliable results. In addition, the internal, external and construct validity are the main areas in which potential lack of rigor could be found [67, 77, 78]. The many weaknesses of single case study analysis are put forward, even by more optimistic scholars, concerning the great difficulty of using case studies in developing theories [70] and the inability to generalize the particular results obtained. As stated by Eisenhardt [70], the case study method represents a mere starting point for the development of theory, and becomes a basis for “analytical generalization”, rather than a “statistical generalization”, only when it involves several case studies [67]. According to Eisenhardt [70], the correct number of case studies goes from four to ten. Moreover, even if a case study could investigate those concepts and theories that are not yet well developed, or validated, findings are generally limited to a certain time, place and condition [67, 79].

Therefore, in this research paper, in order to investigate auditors interest in XBRL according to the framework explained above, a multiple case study approach is proposed, involving the Big Four auditing firms. A multiple case study approach is considered as a variant of the case study [67]. Therefore, it maintains

all the advantages of the case study, and, at same time, it reduces the typical weaknesses of the single case study. The multiple case study method, in fact, holds the potential to provide more compelling and robust results [80]. Moreover, the single case study analysis of specific situations affords results that may be generalized only with difficulty. Instead, the multiple case study approach allows direct replications of cases [67], thus allowing differences and similarities to emerge among them. Furthermore, if two or more cases reveal analogue conclusions, the possibility to expand the generalization of the findings is higher [67].

The aim of this investigation is to make a direct replication on the Big Four auditing firms, submitting questions related to the framework proposed, in order to accomplish a detailed understanding of the reasons explaining the auditors interest. Multiple case studies can effectively offer the possibility of highlighting the shared/different causes of interest, based on the auditors' experience.

As foreseen by grounded theory, a case study analysis is generally combined with other kinds of data collection, such as interviews, questionnaires, observations, and doing so with both qualitative and quantitative evidence [81]. In the context of the multiple case study analysis, a multi-perspective interview study followed [67], first selecting the interviewees who are more likely to have significant information related to auditing activities and XBRL. For this step of the research, the interviewees—3 managers and 3 senior managers for each Big Four—were contacted. Informational material on XBRL was sent to them by e-mail; after that, a set of semi-structured interviews were held, guided by a written prompt sheet, so that discussion was allowed to flow, and key points to be highlighted. Interviews were based on the four perspective of the framework, according to a common path to be followed. To generate trustable data, managers and senior managers were interviewed apart, so to avoid outside influences. In fact, one of the strong points that arose from the multi-perspective approach is that auditors belonging to the same auditing firm can generate different data from interviews. Multiple interviews allowed the different needs of auditors to emerge, different causes for their interest in XBRL and both similarities and differences in their perception about audits to be done on XBRL-related documents.

Interviews were conducted mainly through open-ended questions. Open-ended questions have advantages and disadvantages. The advantages relate to the possibility of discerning the real beliefs concealed behind the opinions expressed by the respondents and to the capacity of deeply understanding the reasons of discordant opinions for homogeneous interviewees. The disadvantages of this method are mainly related to the wide variety of answers obtainable, making scoring and coding difficult [82]. However, given the breath of the issue and the exploratory aim of the research, and given the unforeseen number and variety of subjective opinions and perceptions that auditors expressed, open-ended questions seem to be the best solution to grab as much information as possible.

Each interview took about 45 minutes and was recorded. Interviews were later transcribed in order to achieve a content analysis using the support of the software Atlas.ti 6.2[®] to compare them to each other, to isolate the key opinions common

among auditors, and then to discern the differences among them. The scientific validity of this approach is confirmed by Yin [67], Fink [83] and Berg [84].

Interviews were held with 3 managers and 3 senior managers for each of the Big Four auditing firms in order to understand which were the main reasons for their low interest in XBRL and which could be the triggers for boosting their XBRL interest. In total, 24 auditors were interviewed. Questions posed according to the framework perspectives were submitted in order to allow the opinions of each auditor emerge for each category. The main aims pursued were:

- *Regulatory*: in this perspective, questions submitted to auditors are aimed to allow their opinion emerge on the relevance of regulatory requirements in developing their interest for XBRL and on the possibility that, as a result of a new regulatory law, the auditing of XBRL financial statements becomes mandatory;
- *Economic*: in this perspective, the role of the possible economic advantages arising from an XBRL auditing has been debated as a basis for the development of the interest in XBRL;
- *Technical*: in this perspective, questions posed to auditors are oriented to understand how and why the technical opportunities and complexities of XBRL could be a trigger for developing auditor interest; more specifically, the opinions of the auditors can reveal whether they identify possible advantages (or disadvantages) of XBRL in performing their auditing activities;
- *Cultural*: in this perspective, questions posed to the auditors are aimed at highlighting their points of view regarding the relevance and innovation introduced by XBRL, regarding XBRL impacts on the auditing procedures, and its effects in defining a new approach for auditing a financial statement. Table 2 reports some of the main open-ended questions submitted to auditors.

Table 2 The main questions of semi-structured interviews

<i>The regulatory perspective</i>	<i>The economic perspective</i>
Should the auditing of an XBRL financial statement be mandated by law?	Is there the possibility to gain profits through an assurance/auditing activity on XBRL-related documents?
Are there in Italy enough legal requirements regarding XBRL?	Is XBRL a new source of business?
How much important is the legislature intervention in promoting the auditing of XBRL-related documents?	Does XBRL imply new costs?
<i>The technical perspective</i>	<i>The cultural perspective</i>
Does XBRL lead to any changes in auditing procedures?	Is XBRL more than a new IT tool?
Does XBRL provoke resistance to adopt new automatic techniques?	Does XBRL change the approach to auditing?
Does XBRL change the IT work?	Which are the conditions for diffusing the XBRL innovation?

Since the aim of the research is to test the framework presented in the previous sections of this research paper, the structure of the interviews has been designed in a way to submit questions for each perspective, according to our theoretical propositions.

4.2 Findings

The answers of the auditors were transcribed and analyzed in order to detect shared opinions on issues related to the four perspectives of the framework. As a result of the multiple case study, three categories of respondent have been identified. Each category has a different view of the causes of the low interest in XBRL. The first (*regulation is the key*) is composed by the interviewees which consider the regulatory perspective as the most important in promoting interest in XBRL issues. According to this category, the regulatory perspective could be the first way for the diffusion of XBRL and for the development of interest in XBRL issues.

The second category (*higher profit for higher efficiency*) is composed by auditors which consider the economic and the technical aspect of XBRL as closely related among them and thus the most suitable in developing interest in XBRL. According to them, if XBRL could bring profits, then it will be largely adopted, and, as a consequence, the interest in it will increase. At same time, auditors assert that, in addition to the profit, if XBRL will be correctly adopted it could bring many advantages in terms of data integration, technical efficiency and effectiveness. Therefore the development of interest in XBRL could arise from the combination of such two elements.

The third category (*cultural reserves*) states that the main cause of the low XBRL interest has cultural nature. That is, since XBRL contains the same information of a traditional financial statement, the adoption of XBRL could be perceived as useless. Moreover, as XBRL could lead to new IT skills and competences and as a result could affect the auditing activities, a resistance to change is likely to happen.

Hereinafter such categories will be analyzed in detail, also quoting some of the most significant statements of the auditors interviewed in order to make as evident as possible which are the shared opinions of the interviewees.

Category One: Regulation is the Key. With regard to the first category, it is composed of 11 respondents, specifically 6 senior managers and 5 managers. As said above, questions asked to the interviewees were aimed at grabbing the auditors opinion about the four perspectives introduced in the framework. This category embeds the set of auditors whose answers are similar for meaning.

The first impression which emerges from the auditors interviews is that they did not realize any impact of XBRL on their auditing activity, and also inside the audited companies, they did not perceive any change due to the introduction of XBRL.

About such a particular category, several opinions converged in recognizing a relevant role of the regulatory boards in promoting interest towards a new matter like XBRL.

As it happened for IFRS, when laws regulated the approach to be followed for the IFRS adoption, auditors state that it should happen the same for XBRL for increasing their interest in XBRL. Therefore, auditors interviewed are expecting an important legislature intervention in promoting their interest in XBRL, such as the definition of the rules for performing the auditing activities, the definition of the scope for carrying out an XBRL assurance, the technical implications and costs of such new duties, the software to be used and the fees to be applied for accomplishing such a new service.

This is one of the reason that explain why XBRL benefits are not a driver for interest in XBRL: auditors cannot know, actually, which could be the benefits arising from XBRL because benefits will depend on the regulatory requirements.

Judging from the expectation of the auditors and from their answers, it seems to be confirmed the principles of a normative isomorphism. In fact, in this category each auditor feels the need to receive a rigorous set of rules to follow, in order to comply with and to take advantage from law requirements for making clearer its ideas about XBRL, that is, opportunities, costs, benefits and technical implications of XBRL.

Therefore, the way in which an XBRL assurance will be performed, the effects on the auditing procedures, the costs and the profits which will arise from, are all issues which depend on the rigor that the regulatory board will give to the legal requirements. Furthermore, auditors also expect that the complexity of XBRL assurance procedures defined by the legislature could also affect auditing costs, hence bringing about the likelihood of applying additional fees.

In other terms, auditors belonging to this category recognize in law the main trigger to be activated for developing their interest in XBRL and the following point extracted from the interviews, reveal their opinions about it:

The depth of the XBRL assurance will depend on the rigidity of the schemes defined by the regulatory boards: if the approach of the legislature is too soft, the XBRL assurance could be considered as only one more new task for IT. Moreover, according to the approach the legislature adopts for introducing an XBRL assurance, it might be possible to apply further fees.

Another opinion that auditors expressed is that actually the regulatory boards do not provide requirements about XBRL auditing activities; rather, XBRL is thought to be useful only for the final deposit of the financial statement and thus all the auditors' activities preceding it are entirely unaffected by XBRL.

On the contrary, one auditor states that XBRL assurance could be helpfully achieved on interim financial statements, because about the 98 % of their work is carried out before producing the final financial statement.

As a further confirm of this opinion, a statement of another auditor interviewed is quoted:

The software related to XBRL is used when the auditor's job is already concluded, therefore it involves only the deposit of the financial statement. But at that point, it does not matter anymore for us.

As a result for this category, according to several auditors, regulatory bodies have a determining role in establishing how deep an XBRL assurance should go and which tasks it could involve. Thus, the regulation perspective for these interviewees is seen as the "key" for stimulate their interest in XBRL. The effect of this is likely to be a normative isomorphism.

Moreover, as it emerges from the interviews, almost all the auditors interviewed recognize that the regulatory perspective is the first element to be considered for promoting their interest in XBRL, because the regulatory perspective can affect also the other perspectives of the framework. As an example, technical and economical perspectives are both depending on the legal requirements.

Category Two—Higher Profit for Higher Efficiency. This category consist of 8 respondents, in detail, 3 senior managers and 5 managers. The answers received by the auditors have in common the recognition of a close relationship between the technical and the economic perspective.

Obviously, auditing firms could have a great interest in XBRL if benefits exceed costs related to its implementation, adoption and successive assurance activity. Observing the results of the interviews, it clearly emerges a real difficulty for respondents to divide the economic from the technical perspective, being very strictly linked among them.

The interest in XBRL, for this category of respondents, depends on the possibility to take advantage from the technical efficiency allowed by XBRL and, at same time, to take advantage from the higher profits that could arise from an XBRL assurance activity. In other terms, a part of interviewees belonging to this category think that XBRL can allow to reduce costs, making leaner the procedures, higher the timeliness and more effective the controls, thanks to the higher level of automatism, and, also, they think that XBRL could be a new profitable business. According to the auditors, XBRL could also allow better linkages with the client firms, in addition to a higher efficiency and effectiveness of their work.

Another part of respondents of this category, more prudently wonder which could be the additional costs that XBRL could bring about.

What emerges is a difference of opinion, but united by an interest in technical and economic aspects of XBRL. Thus, the Cost-Utility Analysis made by auditors does not return consistent results, but differing ideas on the convenience to perform an audit on XBRL financial statements or not. Indeed, questions regarding the costs and the profits that can arise from an XBRL assurance affect some main considerations: the cost of additional work for the IT staff; the cost of additional work for auditors; the profits obtainable from an XBRL assurance service. Regarding the IT staff, some auditors state that IT would be actively involved on new software and new IT activities, so making necessary further training costs; whereas, according to other auditors, the IT staff might take advantage of the

higher standardization achievable with XBRL, thereby reducing the overall effort and costs.

Still, other auditors assert that the IT specialists is the entity least affected by the XBRL assurance, since IT is considered very accustomed to dealing with never-ending innovations for information technology. Therefore, according to them, the effects on the IT costs could be very irrelevant. In the opinion of this part of auditors, it is likely that IT specialists will suffer an increase in workload, but quite surely they could improve the quality of their work taking advantage from XBRL language without further expenses.

About this point, the following statement extracted from an interview with a senior manager, is quite significant:

In some environments, like banks, the IT specialists have to achieve the auditing activities, therefore XBRL for them could mean additional work, but not an increase in costs.

Regarding the standardization achievable with XBRL, it is considered by auditors as one of the main strength points of XBRL, as it could allow to make uniform the reclassification criteria of interim financial statements, making them comparable with each other in a company.

As follows, a significant statement expressed by a manager on the benefit effects of XBRL for the IT staff:

IT could take advantage of the efficiency arising from the standardization of some procedures for the traceability of the operations that are carried out from the general ledger to the reclassification. If this reconciliation is easier, it also adds up to saving of time and money for companies.

About the additional costs for auditors, opinions are differing. The majority of auditors belonging to this category think that auditors will not have a real increase in their workload. It could be more likely that some control procedures will change because of the XBRL automatism and that business data will be available with a higher level of timeliness, but this part of auditors do not think that XBRL will increase their workload and this also because thanks to the higher IT efficiency, auditors could be more usefully supported by IT staff. Such a better support can have positive effects also on the auditors' job. Recognizing the usefulness of a new technology is one of the main points of the TAM theory. In fact, studies on the TAM theory showed that the main factors of the acceptance and use of a new technology are the perceived usefulness—for example the improvement of the performances in access, compare and analyze XBRL financial statements—and the ease of use—for example the recognition that a new XBRL-related software can lead to higher efficiency with lower efforts.

Another line of thought which emerges from the interviews is that auditors will have to increase their IT skills given to the fact that they will have to work more closely with the IT specialists. This could lead to a general increase of training costs. Even if the IT staff will be positively affected by XBRL, it follows that auditors should, in any case, align their skills with those of the IT staff.

Regarding the profits which could arise from an additional XBRL assurance or XBRL auditing, interviewees belonging to this category have in common the idea that they could incur another risk by certifying another kind of financial statement (i.e. XBRL financial statements). The certification of correspondence between XBRL financial statement and the traditional financial statement could thus bring about new profits.

As follows, regarding this point, one statement from a manager well represents the common view of the whole category:

For assuring an XBRL financial statement, the auditor would have another responsibility. It may indicate “x” days, “y” hours required and therefore ask for an increase in fees. So there might be an increase in revenues for auditors but I’m almost sure that if an increase in costs will happen, this will be surely limited.

This category of respondents shows which are the main impressions of auditors regarding the XBRL assurance to the regime, and not just regarding the XBRL implementation. On the basis of the impressions expressed by auditors, it is enough clear that it is difficult for them to make a conscious Cost-Utility Analysis, since they never made auditing on XBRL financial statements; it is also quite clear that, whatever the line of thought, the interest in XBRL for these auditors is closely linked to the technical complexity that XBRL will lead and, subsequently, to the economic effects. In any case, the majority of interviewees expresses its interest in XBRL in terms of saving time and money, due to the improvement of technical efficiency in the IT procedures and, as a consequence, in the auditing procedures. Auditors express interest also in terms of new profits, due to the limited costs that XBRL could bring about and, at same time, the likelihood to apply new fees. The main points that emerge from the interviews are that the interest of auditors for XBRL is due to the potential improvement in the efficiency of the work, to the advantages arising from the better data comparability allowed by XBRL, to the business data integration and lower errors rate, and at same time, to the consideration that XBRL might be a new source of business.

Category Three—Cultural Reserves. This category is composed of 5 interviewees, that is 3 senior managers and 2 managers. Opinions related to this perspective have all in common the recognition of cultural limits in promoting a new Information Technology tool like XBRL. This is aligned with the principles of the Diffusion of Innovation Theory. According to such a theory the key elements of the diffusion are the innovation, the communication channel, the time and the social system [56]. Therefore, XBRL would stand for the “innovation” and the regulatory and institutional boards would stand for the communication channel. Time is the speed with which the innovation is used by the members of the social system (auditors) [56]. According to the real situation even if the innovation does exist, an effective communication channel seems to be still lacking.

In fact, according to auditors belonging to this category, the interest in XBRL will be stimulated only when information on XBRL are available and complete, and when the cultural resistances to the innovations will be surpassed. Culture

represents the first stimulus for encouraging change in any sector and promoting interest in any matter.

Auditors which answer to the interviews consider the interest in XBRL as dependent on the level of information available on it. A sufficient degree of information on XBRL could surely improve the interest in XBRL, but actually, such a level of information seems to be still low. Some auditors stated that they do not receive any information from institutions, and until there is such a little external XBRL informational, XBRL will remain vague.

Also, some reserves are expressed by the auditors on the possibility to develop interest on XBRL, because information related to it are either not available or not complete. As follows, an answer which confirms that information is one of the most significant triggers for stimulate XBRL culture and consequently, interest in XBRL:

There is a very low level of information. Even if we know what XBRL does, we still don't understand the ramifications.

The common view of this category of auditors is that XBRL will be implemented only for a final deposit, and this makes XBRL just another bureaucratic measure to be endured. According to these auditors, one of the main causes of the poor interest in XBRL is the limited use of XBRL, since it refers only to the final deposit of financial statement.

Instead, information about the potentialities of XBRL could help auditors in developing interest and to consider the real benefits of such an innovation. One of the answers received from a senior manager, following quoted, is very significant for explaining this point:

I can't find information to address this question: if companies implement XBRL, which advantages might they gain? How can XBRL be useful to us in practice?

Another issue that can counteract the interest in XBRL is the resistance to change related to the different way to perform the auditing activities. This point is closely related with the technical perspective. Only a few auditors agreed that the introduction of an innovation like XBRL has not serious impacts on the IT staff, since they are very accustomed and open to IT tools, but, if anything, XBRL might have impacts on the auditing activities, as it could lead to a more innovative auditing approach one.

Instead, the majority of respondents stated that the auditing of an XBRL financial statement could be interpreted as a duplicate activity, given that the auditing of the traditional financial statement is supposed to be not abandoned. Therefore, since the traditional auditing activities will still be conducted, auditors express doubts about the usefulness of a replication of those activities on a different format of the same financial statement. Thus, a new auditing approach for a new financial statement format seems to be difficulty accepted.

In this sense, the auditors of this category recognize the relevant role that regulatory boards will have in establishing rules, extent and approach to be followed for performing an XBRL auditing activity.

These considerations make clear the existence of linkages between the categories, and, especially with reference to the culture, the linkages seem to be stronger given that all the other categories are, in a certain way, considerable as a little part of the wider concept of “culture”.

Another interesting insight emerging from the interviews is that almost all the auditors belonging to this category evoked the financial scandals as the main trigger prompting change in Italy, explaining that when a fraud, which could have been avoided through the use of XBRL, is unmasked, then XBRL will get attention.

An Analysis of the Relationships Between the Case Studies. The results of the interviews allowed to classify auditors in categories ordered on the basis of the frequency with which they have considered as relevant the same perspective. In Fig. 2 it is represented a graphical illustration of the answers received from auditors, with respect to the four perspectives analyzed.

As we can see, the perspective which has been perceived by auditors as the most important for stimulating an XBRL interest, is the regulatory one.

In second place, we find the economical/technical perspective, considered strictly linked because of the reciprocal effects.

In third place, there are auditors who deem the cultural perspective as the main cause of the lack of XBRL interest, since it is the auditing profession’s alliances and culture itself that might inspire real interest and the dissemination of informed opinion about the potential benefits concerning XBRL assurance.

The four perspectives are not widely separated from each other, but instead closely linked. Figure 3 offers an illustration of the relationships among these perspectives.

The effect that arises from each perspective is reflected in at least one of the other perspectives. The most evident linkages are those regarding the regulatory implications on the technical and economical issues, but, in a wider sense, the

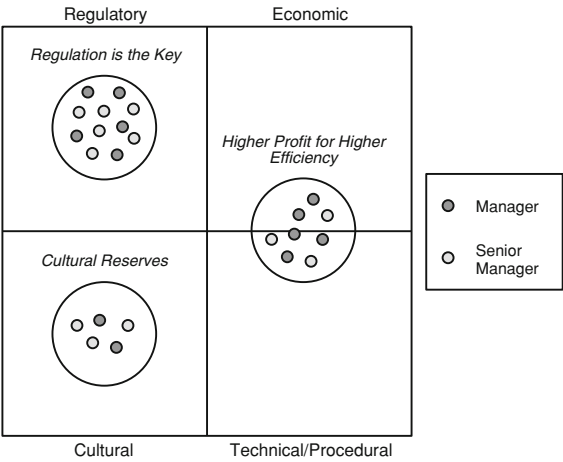


Fig. 2 The test of the framework

linkage between the cultural perspective and all the others is very evident. In fact, for achieving “cultural” diffusion of an innovation technology, such technology has to be previously accepted from the social system. In turn, the social system, in order to accept a new technology, requires to recognize its usefulness and benefits.

Further, starting from the regulatory perspective, a ramification involves the economic perspective and the technical one. Regulation can in fact establish the techniques to be followed and the fee to be applied. Also in alternative, technical perspective can affect the economic one, in case no fixed fees are established from regulatory boards. In this case, the more new auditing procedures are complex and involve new software, new skills and new work, the greater the effects on the economic dimension will be.

Moreover, if regulatory boards impose a “soft” XBRL assurance approach, the law will become just another new legal compliance issue. If the legislature requires a “hard” mandatory XBRL assurance approach, then audited companies will suffer a new investment and managers will want to know clearly which are the related remunerations and advantages.

Finally, a lack in the culture perspective has effects on all the other perspectives. Poor information about XBRL can compromise understanding about its advantages and potentials, thus undermining the likelihood of developing interest in XBRL. Looking at it from the other side, when the skills, the experience and the practice are developed over time, they can become a central cultural element and can contribute to an increase in the cultural attention to XBRL. Similarly, a lack of institutional attention to XBRL can have effects on the economic advantages that might accrue from an XBRL assurance. When regulatory agencies feel the need to regulate XBRL audit activities, then they will contribute to both the technical and procedural dimensions (see Fig. 3) and to the culture as well.

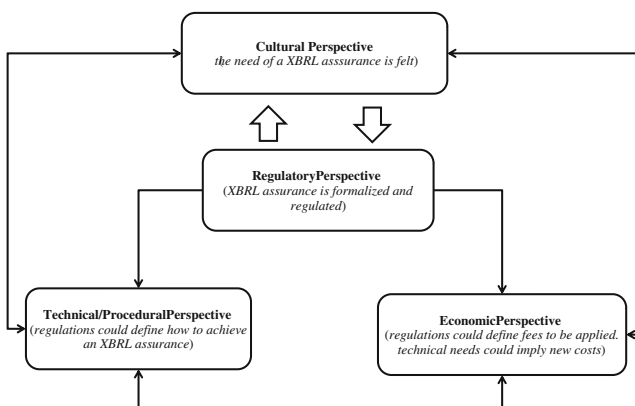


Fig. 3 The relationships inside the framework

5 Conclusions

This research paper tries to bridge a theory–practice gap related to XBRL, providing evidence about a great disparity in attention that exists between academics, on one side, and auditors, on the other, concerning the practical utility of XBRL.

In fact, on the theoretical side, scholars have focused attention on the benefits that XBRL could allow for a wide category of stakeholders, considering auditors as the primary stakeholders who ought to become more involved in XBRL. A number of reasons have been advanced in support of a greater role for auditing in the XBRL era such as an improvement in corporate governance and auditing, as a part of the corporate governance framework, in the development of continuous assurance/auditing techniques, in automatic validation of calculated numbers or compliance with disclosure checklists and, generally speaking, in an easier, efficient and effective auditing activity.

Nonetheless, on the practical side, poor attention has been paid to how and why XBRL may really interest auditors. On the empirical side, evidence shows that the expertise of auditors in XBRL assurance procedures is not as high as it should be and a lack of interest, knowledge and experience in XBRL emerges. A low auditor interest in XBRL can be explained by the present situation in Italy, where traditional financial statements accompany the instance documents. Both versions are often presented for external consumption. In this scenario, assurance would include the attestation that the data presented in the instance document is the same as the data in the audited financial statements and that both comply with regulatory and legislative requirements [13].

Given such a gap, this paper aims to survey the interest in XBRL within large Italian auditing firms, proposing a framework composed of four perspectives, in the hypothesis that one or more of these contribute to the state of inattention by auditors for XBRL: regulatory, economic, procedural/technical, cultural.

As the aim of this research is to survey auditor interest in XBRL, we made a preliminary survey in order to insure that the low interest of auditors does not depend on poor knowledge of XBRL benefits. The result of the preliminary survey shows that auditors are not influenced by the benefits of XBRL and thus it is possible to exclude the notion that XBRL benefits are a driver for interest in XBRL. Other causes can thus explain the limited interest of auditors in XBRL. Therefore, in order to find them, we performed a more in-depth multiple case study analysis.

Results from this study's interviews confirm the higher significance played by the regulatory approach, compared to other perspectives proposed in the theoretical framework. Strengthening the limited grasp of XBRL among auditors would promote their usage of the program, so that many of the benefits described for XBRL in the scholarly literature might become a reality in the everyday business sector.

As a result, before a new expectation gap arises, or a new financial scandal comes out, auditing professionals should be strongly involved in the XBRL digital format. Although the findings of this research cannot be extended and considered broadly applicable, some conclusions can be offered in order to better understand

the future prospects of XBRL auditing, especially in countries where SMEs are the predominant kind of company. In this regard, auditor involvement would allow unlisted companies to create individual extensions that can be submitted to the independent auditors in order to be verified. Such individual extensions may allow unlisted companies to take advantage from the XBRL benefits that scholars recognize for larger companies. Moreover, although the small-medium unlisted firm is the most widespread model in the Italian economy, actually it is not likely that an XBRL assurance service was voluntarily asked for by unlisted companies, unless a specific regulatory intervention is arranged.

The risk implicit in an only formal control would be avoided by stimulating professional bodies to study and adopt the XBRL technology. Furthermore, the investigation presented in this research paper should be extended to other countries, or into other contexts where XBRL reporting is compulsory, in order to understand which attitudes predominate in determining auditors' interest—or lack of it—in XBRL.

Standard setters and regulators around the world may refer to the framework proposed in this research paper in order to study and analyze how XBRL should be implemented in a specific country, how to involve auditors and how to develop interest and involvement in XBRL.

This research paper also answers to an increasing need of empirical and behavioural research claimed by scholars, and still required, regarding the investigation of the real opportunities offered by XBRL, beyond the mere implementation for legal requirements. Future researches on this topic should be addressed in order to investigate the way in which XBRL can effectively create value for an auditing firm and which implications could affect the audited firms.

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Internal Control Over Financial Reporting Quality and Information Technology Control Frameworks

Stefano Azzali and Tatiana Mazza

Abstract The objective of this research is to investigate the relation between the Internal Control over Financial Reporting (ICFR) Quality and Information Technology Control (ITC) frameworks compliance. We selected a sample of listed companies in the manufacturing, service and finance industries in Italy. The data were collected with interviews and questionnaires for ITC information and through financial reporting for ICFR Quality. The research methodology included univariate, multivariate and simple linear regressions. The Dechow et al. model, the Kothari et al. model and the Healy model adapted to the finance industry are engaged to measure ICFR Quality. The results show that compliance with COSO report in the manufacturing and services industries and with COBIT and COBIT for SOX frameworks in the finance industry is positively related to ICFR Quality: companies that follow these frameworks' processes, objectives and test frequency requirements decrease Discretionary Accruals.

Keywords Information technology controls • Internal controls over financial reporting • Audit quality

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1 Introduction

The Sarbanes–Oxley (SOX) Act was enacted in 2002 by the US Congress to protect shareholders and stakeholders from fraudulent corporate practices and accounting errors. The same protection began in Italy with the law 262/2005. These laws focus on the reliability of financial reporting, assigning the responsibility for the internal control over financial reporting (ICFR) to the Chief Executive Officer (CEO), the Chief Financial Officer or other similar figures specialized in ICFR.

ICFR have been defined by the PCAOB [1, 2] and by the SEC [3, 4] as “A process designed by, or under the supervision of, the issuer’s principal executive and principal financial officers, or persons performing similar functions, and effected by the issuer’s board of directors, management and other personnel, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles”. This definition is consistent with the statement of the Committee of Sponsoring Organizations of the Treadway Commission [5].

The ICFR can be divided in Entity Level Controls (ELC), Process Level Controls (PLC), and Information Technology General Controls (ITGC): the Chief Financial Officer and CEO must evaluate each component of the ICFR to assure the reliability of financial reporting. Because Information Technology (IT) plays an essential role in accounting information systems, the evaluation of the IT audit cycle is a key element of ICFR Quality.

Companies may organize ITC following some frameworks: COSO [6], COBIT [7] and COBIT for SOX [8]. The objective of the chapter is to study the relation between ICFR and ITC frameworks: our hypothesis is that compliance with some aspects of these frameworks could be useful to explain the ICFR Quality.

This study proceeds as follows. The next section analyzes the background and the previous literature. The third section explains the hypothesis that framework compliance (investigated through the number of processes and objectives covered by tests and through test frequency) is positively related to ICFR Quality, as well as the regression model highlighting the variable definitions. The fourth section describes the study design (database with interviews and questionnaire), the sample and the robustness. Descriptive statistics and the regression results follow, respectively in section number five and six. Finally, the last section highlights the conclusions.

The decision to focus on Italian companies is suitable for the following reasons. Firstly, as in the USA, the Italian capital market has been characterized by great failures (for instance, the Parmalat and Cirio cases) that have led to new regulations (law 262 and SOX). Secondly, the Italian law is similar to SOX, but Commissione Nazionale per le Società e la Borsa (CONSOB)¹ does not define useful guidelines or frameworks for improving ICFR. Thirdly, IT controls in Italy are one of the most critical areas of ICFR that need specific frameworks to be well designed and implemented.

¹ The equivalent of the SEC in Italy.

2 Background and Literature Review

2.1 Audit and ICFR Quality

We evaluate ICFR Quality with models employed for Audit Quality. Following this approach, for the manufacturing and service industries, we separate earnings into operating cash flows (CFO) and total accruals and use the cross-sectional Jones [9] model as modified by Dechow et al. [10] and by Kothari et al. [11] with a performance adjustment to estimate the nondiscretionary and Discretionary Accruals (DA). We use two different measures of DA to address potential errors associated with their measurement. For the finance industry, we adapt the Healy [12] model.

DA have been used as a proxy for ICFR Quality because they can capture the Quality of accounting information. Following Mascarenhas et al. [13], we use DA because audit activities are likely to be more efficient for cash flows and non-discretionary accruals. Following Subramanyam [14] and Tucker and Zarowin [15], we employed DA because they are an instrument for earning management. Like Myers et al. [16], Choi et al. [17], Chi et al. [18], we believe that ICFR Quality is related to the level of accruals in financial reporting; low/high quality audits affect earning management and can aid in “pushing the boundaries” of standards. This view is consistent with the SEC’s guidelines that high ICFR Quality will lead to high earning quality.

We do not follow the approach [19–21] for ICFR evaluation based on Control Deficiencies (CD), Significant Deficiencies (SD) and Material Weaknesses (MW) because we have significant difficulties in the collection of useful information from companies because the companies are not requested to disclose CD, SD and MW in Italy. We think that previous literature does not adequately consider the problem connected to the ICFR Quality evaluation in countries with no transparent communication to investors of CD, SD and MW. To solve the gap, this chapter tests Audit Quality models for ICFR Quality evaluation because ICFR are an essential component of both external and internal audit.

2.2 ITC Frameworks

The research considers as independent variables the numbers of ITGC processes and objectives, the numbers of IT ELC objectives, and the tests frequency, as requested from COSO report [6], COBIT [7] and COBIT for SOX [8]. Some ICFR frameworks include the IT area [1, 2, 6], whereas others are specialized in IT [7, 8, 22–24]. In this context we choose 3 frameworks (COSO, COBIT and COBIT for SOX) because we recognized that they are the most employed in Italy on a voluntary basis.

COSO developed a model for internal controls and corporate governance [25, 26]; although the model can be applied to IT, it is not designed to focus on

ITC [26, 27]. COSO (version 2006) includes ITGCs in principle n 14, and they are classified into systems development, change management, security and logical access and computer operations (4 processes). The same taxonomy is used in the guidance of AS5 [28].

The IT Governance Institute (ITGI) created many versions of professional frameworks focused on IT (COBIT) and on compliance for SOX (COBIT for SOX). **COBIT**, version 4.1, is an IT governance framework [26, 29, 30] that proposes the following work scheme: each control should have a control objective linked to a risk to cover; the control objectives are grouped into processes and are related to business objectives oriented toward the reliability of financial reporting and the qualifications of the information [7, 31]. COBIT 4.1 analyzes IT controls in 4 domains, 34 processes and 210 objectives: 2 domains, 14 processes and approximately 100 objectives are related to IT ELCs, and 2 domains, 20 processes and approximately 110 objectives are related to ITGCs. **COBIT for SOX** studies IT control objectives with their relationship to financial reporting and selects only the principal control objectives to comply with the Sarbanes–Oxley Act [8]. COBIT for SOX describes approximately 23 processes and 150 objectives: 11 processes connected with 4 COSO components and divided into approximately 70 objectives for IT ELC and 12 processes divided into approximately 80 objectives for ITGC.

In Europe there are no compulsory guidelines for ICFR, therefore this research aims to verify the usefulness of voluntary adoption of ITC frameworks as measure of ICFR Quality in Italy.

3 Research Hypothesis and Model

3.1 Hypothesis

Compliance with the COSO, COBIT and COBIT for SOX frameworks increases ICFR Quality.

The compliance is investigated through the number of ITGC processes and objectives, the number of IT ELC objectives and tests frequency.

3.2 Model

$$\begin{aligned} \text{ICFR QUALITY} = & \alpha + \beta_1 \text{ITGC processes}_i + \beta_2 \text{ITGC objectives}_i \\ & + \gamma \text{IT ELC}_i + \delta \text{TESTS FREQUENCY} \end{aligned} \quad (1)$$

i Distance from COBIT for SOX, COBIT, COSO

j Distance from COBIT for SOX, COBIT

We use an OLS regression for the simple and the multivariate regressions and the Pearson correlation for the univariate analysis because the correlation is between quantitative variables (Table 1).

Dependent Variable—ICFR quality. The research contributes to literature proposing a method for evaluating the quality of ICFR. We propose the same models well known in the Audit Quality literature because both external and internal audit cycle are based on ICFR evaluation. As dependent variable we choose ICFR Quality instead of Audit Quality and we measure it with 3 models, different for industry: the Dechow model [10] and the Kothari Model [11] for manufacturing and services industries; the Healy Model [12] for finance industry. We think that the 3 models traditionally employed for Audit Quality could also be useful for evaluating ICFR Quality.

Independent Variables—Compliance with the COSO, COBIT and COBIT for SOX Frameworks. The COSO, COBIT and COBIT for SOX frameworks suggest specific number of processes and objectives in the ITC planning; the chapter recognizes the companies' compliance with these elements of ITC frameworks and the tests frequency.

The hypothesis considers the compliance of companies with the number of processes, objectives and tests frequency, as defined by COSO, COBIT and COBIT for SOX. The reason for this choice is the wide diffusion of ICFR at international level (COSO), the specialization of IT (COBIT) and the selection of only the principal processes and objectives related to financial reporting to comply with the Sarbanes–Oxley Act (COBIT for SOX).

This research investigates the requirements of COSO, COBIT and COBIT for SOX in a sample of listed companies in Italy. The hypothesis is that the employment of these ITC frameworks in Italy could increase ICFR Quality.

4 Method

4.1 Study Design

We have conducted the research through interviews and questionnaires.

Interviews were done to a limited number of companies during the period of May through July 2010. As we do not know the situation in Italy after the implementation of the model to comply with the Italian law 262/2005, we conducted exploratory interviews with a general open question: “How do you evaluate the ITC over financial reporting?”. We asked this question to the internal auditor who has the responsibility to evaluate the ITC in the staff ICFR. The interviews were useful to identify one of the first problem for ITC in Italy: there are no national general guidelines and so many companies implement ITC frameworks (COSO, COBIT, COBIT for SOX) for the compliance with law 262/2005. For this reason we divided the questionnaire in the phases of the ICFR evaluation process

Table 1 Variable definition

Dependent variable = ICFR quality	
<i>Manufacturing and Service Industry:</i>	
1. Dechow et al. [10] (Jones modified model):	
DA = TA - NDA	
NDA = $\alpha_0 + \alpha_1(1/A_{t-1}) + \alpha_2(\Delta REV_t - \Delta REC_t) + \alpha_3(PPE_t)$	
DA = discretionary accruals deflated by lagged total assets as a proxy for low ICFR quality	
TA = total accruals measured as earnings before extraordinary items—operating cash flow, scaled by lagged total assets	
NDA = nondiscretionary accruals measured by a regression in which the coefficients α are estimated with	
TA = $\alpha_0 + \alpha_1(1/A_{t-1}) + \alpha_2(\Delta REV) + \alpha_3(PPE_t) + \varepsilon_t$	
A = total assets	
ΔREV = revenues $t - 1$, scaled by total assets $t - 1$	
ΔREC = receivables $t - 1$, scaled by total assets $t - 1$	
PPE = property plant equipment	
α_0 = a constant included reduces heteroskedasticity Kothari et al. [11]	
t = 2010	
2. Kothari et al. [11] performance-adjusted abnormal accruals:	
DA = TA - NDA	
NDA = $\alpha_0 + \alpha_1(1/A_{t-1}) + \alpha_2(\Delta REV_t - \Delta REC_t) + \alpha_3(PPE_t) + \alpha_4(ROA_{t-1})$	
ROA = return on asset measured by net income for year $t - 1$ divided by average total assets for year $t - 1$	
NDA = nondiscretionary accruals measured by a regression in which the coefficients α are estimated with	
TA = $\alpha_0 + \alpha_1(1/A_{t-1}) + \alpha_2(\Delta REV) + \alpha_3(PPE_t) + \alpha_4(ROA_{t-1}) + \varepsilon_t$	
<i>Finance Industry:</i>	
We have extended one of the first models for the non-finance industry, the Healy model [12], to the finance industry and call for other studies to resolve biases. This simple model treats the set of observations for which earnings are predicted to be managed upward as the estimation period, and the set of observations for which earnings are predicted to be managed downwards is treated as the event period; thus, the mean of the total accruals from the estimation period represents the measure of the nondiscretionary accruals:	
NDA = $\sum TA_t/A_t$	
As the sum of the total accruals, we use the sum of the following identified income statement components that can be managed with opportunistic behaviors and scaled by the total assets of 2010:	

(continued)

Table 1 (continued)

Dependent variable = ICFR quality	
Gains and losses on financial assets/liabilities at fair value through profit or loss	
Impairment losses on (a) loans, (b) available-for-sale financial assets, (c) held-to-maturity investments, (d) other financial assets	
Net provisions for risks and charges	
Impairment/write-backs on property, plants and equipment	
Impairment/write-backs on intangible assets	
Gains and losses on tangible and intangible assets measured at fair value	
Impairment of goodwill	
Independent variables = Compliance with the COSO, COBIT and COBIT for SOX frameworks	
NUMBER OF ITGC PROCESSES AND OBJECTIVES	Cross-sectional euclidean relative distance between the number of processes from the questionnaire and this number as defined by COSO, COBIT or COBIT for SOX for ITGC.
NUMBER OF IT ELC OBJECTIVES	Cross-sectional euclidean relative distance between the number of objectives from the questionnaire and this number as defined by COBIT or COBIT for SOX for ITGC. Cross-sectional euclidean relative distance between the number of objectives from the questionnaire and this number as defined by COBIT or COBIT for SOX for IT ELC. The regression applied are: A multivariate regression with the first two euclidean relative distances as independent variables separately (PROCESSES AND OBJECTIVES) for ITGC. A simple regression with the sum of the two euclidean relative distances as independent variable together (processes + objectives) for ITGC. A simple regression with the third Euclidean relative distance as independent variable (PROCESSES AND OBJECTIVES) for IT ELC. The number of processes is defined in the principle n 14 in the COSO report [6], in the pages 33–36 (ITGI 2006) and in the APPENDIX C for the COBIT for SOX, and in the control objectives COBIT 4.1 (ITGI 2007). We also consider the number of objectives for the COBIT and the COBIT for SOX.
TESTS FREQUENCY	1 = only annual 2 = mainly annual 3 = 50 % annual, 50 % six-monthly 4 = primarily six-monthly

identified by these ITC frameworks: framework selection, plan and organization, scoping, risk assessment, testing design and operating effectiveness of controls, evaluation of control deficiencies and reporting. This chapter mainly addresses the phases of planning and testing. The questionnaire was prepared by a team composed by academic researchers and external auditors from Big4. We selected instruments for each construct based on frameworks and we discussed them. The help of the external auditors has been very important to assure a simple understanding language for the target companies. Then, we tested the questionnaire on three firms: a bank, an insurance and a manufacturing firm who were within the target population. They answered the questionnaire and provided comments. This permitted us to make some adaptations to refine the study's design as well as the measurement of some of its constructs. The questionnaires were mailed in 2011 addressing the evaluation process for the year 2010, and the responses were received in a narrow time frame (three months). The results have been presented in an academic seminar. We contacted by phone the companies that have not answered yet to increase the response rate. We decided to assure confidentiality to the answer to the questionnaire (i.e., we know the name of the company that answered at the questionnaire but we cannot disclosure this information; we can show the results only in the aggregated form). This decision leads us to link the data collected with other sources. In addition, our association with the university assures a greater response rate because the firms are protected from the disclosure of private information by a well-know and trusted institute. Excel, SPSS, STATA and EViews software packages were used to perform all statistical analyses.

4.2 *Sample*

The population are the Italian listed companies at Milan Stock Exchange implementing ITC that are explicitly targeted at monitoring and assuring compliance with law 262/2005.

The sample for the elite interviews includes 3 companies, 1 company from each industry (the banking, the insurance and the manufacturing and service industries), because different industries have different IT systems and different internal control systems.

The sample for the sending of the questionnaire has been selected with the purpose to generalize the results to the Italian context. To exclude the companies that have not an ITC evaluation process we selected the sample based on capitalization: a larger weight has been assigned to companies with higher capitalization. The variable used for the stratification of the sample is the capitalization because lower capitalized firms are likely to have less resources for the ITC evaluation process. We sent the questionnaire to a sample of 122 companies. As we can see from the Table 2, the usable responses confirm the stratification hypothesis because larger firms respond more frequently to the questionnaire. The response rate was nearly 41 %. The population is limited (253 companies), so the

Table 2 Sample selection

Criteria	Total number of firms	Sample selection weighted for capitalization	Usable response
Companies listed on the milan stock exchange in 2011—index FTSE MIB	38	30(80 %)	17(45 %)
Companies listed on the milan stock exchange in 2011—index FTSE Italy mid cap	59	35(60 %)	11(19 %)
Companies listed on the milan stock exchange in 2011—index FTSE Italy small cap	128	51(40 %)	18(14 %)
Companies listed on the milan stock exchange in 2011—index FTSE Italy micro cap	28	6(20 %)	4(14 %)
Final sample	253 ^a	122	50

^a We have excluded 19 companies because we have missing data for the following analysis in DATASTREAM/WORLDScope. Because 17 listed companies are not included Index FTSE classification, we included them in this classification taking into account their capitalization

significance of the sample (50 companies that represent nearly 20 % of the population) is comparable with previous researches.

4.3 Robustness

We performed tests for non-response bias for generalize the results and to check whether they were affected by unknown factors that systematically distinguished respondents from non-respondents (control group in panel A, Table 3) and respondents from the other firms of the population (control group in panel B, Table 3). We compared the mean for profitability (measured with Return on Assets—ROA) and size (measured with the total Assets). The data for the control groups have been collected from the financial reporting database DATASTREAM/WORLDScope. The results in Table 3 show no sign of a non-response bias and of differences with other firms of the population according either to profitability or size.

5 Descriptive Statistics

Table 4 shows the numbers of ITGC processes, objective, controls and the number of IT ELC objectives: they give us the opportunity to compare this information with ITC framework and show the degree of compliance. Although not showed in the ITC frameworks, we also recognize the number of controls because it represents an important element in the ITC evaluation process.

For ITGC, the mean number of processes is 5.37. The median (4) is compliant with COSO number of processes; the median is lower than the mean and explains

Table 3 Robustness tested with mean comparison

Variable	Sample mean	Control group mean	Two-groups mean comparison t test with unequal variances (two-tailed <i>p</i> -value)
<i>Panel A: Non-respondents</i>			
Size (total assets)	30173207.46	27845841	−0.1134 (0.9099)
Profitability (operative income/ total assets)	0.0143167	0.0307055	1.1608 (0.2480)
n	50	72	
<i>Panel B: Other firms of the population</i>			
Size (total assets)	30173207.46	11804580.14	−1.6044 (0.1124)
Profitability (operative income/ total assets)	0.0143167	0.0074759	−0.6131 (0.5406)
n	50	203	

Table 4 Descriptive statistics

	Mean	Mode	Stand. dev.	Min	Max	25 %	Median	75 %
<i>ITGC</i>								
Number of processes	5.37	0	6.7	0	34	0	4	9
Number of objectives	34.81	0	121.89	0	800	0	10	26
Number of objectives (without outliers)	16.6	0	24.5	0	130	0	10	26
Number of controls	48.18	0	87.2	0	360	0	21	48
<i>IT ELC</i>								
Number of objectives	5.91	0	13	0	70	0	0	10
							N	%
<i>Tests frequency</i>								
Not applicable							15	30
Only annual							15	30
Mainly annual							8	16
50 % annual–50 % every six months							9	18
Primarily every six months							3	6
Total							50	100

the asymmetry of the distribution toward a high level; most companies define a small number of processes as a result of the risk-based approach. The standard deviation (6.7) is relatively low; therefore, there are homogeneous situations in the definition of the number of processes.

For the number of objectives, the mean (34.81) is lower than the COBIT and COBIT for SOX recommendations (80–110). The median (10) is much lower than the mean due to the outliers of 800 objectives, but without the outliers, the median is confirmed lower than the mean; thus, the asymmetry is toward a high level.

Companies identify very different numbers of objectives based on their own requirements; this difference is shown by the high standard deviation of approximately 24.5.

The same consideration can be performed for the number of controls; there is asymmetry because the median is lower than the mean, $21 < 48.18$, and there is heterogeneity because the standard deviation is relatively high at 90.9. The mean number of controls at 48.18 is higher than the mean number of objectives at 34.8/16.6, which is higher than the mean number of processes at 5.4, with a crescent relationship. Furthermore, the companies that identify fewer processes further increase the number of objectives; nevertheless, the companies that begin with a large number of processes increase the number of objectives less, with some cases in which the number of processes is the same as the number of objectives. The same trend is observed in the relation between objectives and controls: companies that focus on few processes, usually improve the analysis in detail with more objectives and controls.

For IT ELC, the mean number of objectives is 5.91, and the median is 0, far from COBIT and COBIT for SOX frameworks (70–100). Only an outlier identifies 70 objectives of control.

First of all, 46 % of the companies does annual tests frequency (30 % only annual and 16 % mainly annual). Secondly, the companies divide ITC tests 50 % every year and 50 % every six months (16 %). A minority of companies (6 %) realizes ITC tests only every six months.

6 Regression Results

Table 5 shows the regression results between ICFR Quality as dependent variable and compliance with COSO, COBIT and COBIT for SOX frameworks (measured with the number of processes, objectives and tests frequency) as independent variable.

In the manufacturing and service industries discretionary accruals (DA) are significantly related to compliance with COSO (both with Dechow et al. model and with Kothari et al. model), and this framework could improve ICFR Quality in these industries. The sign is positive because the distance from the framework increases DA and decreases ICFR Quality; thus, to obtain high ICFR Quality, companies must reduce distance from the framework requirements. In these industries, probably, ICFR Quality is better realized with a non specialized IT framework, the COSO report, that is easier than COBIT and COBIT for SOX and more suitable for less complex activities.

The distance between ITGC objectives and the COBIT for SOX requirements in the finance industry is significant. This framework is well specialized in IT and focuses on financial reporting to comply with SOX. COBIT is not significant, probably, because it identifies too many processes and objectives to cover the controls, and it is not efficient in relation to ICFR Quality. Finance industry has a

Table 5 COBIT for SOX, COBIT and COSO for ITGC

Expected sign	Manufacturing and services industries						Finance industry		
	Dechow et al.			Kothari et al.			Healy		
	U	M	S	U	M	S	U	M	S
<i>COBIT for SOX-ITGC</i>									
PRO	+	0.039 (0.84)	-0.002 (0.97)	0.075 (0.69)	-0.002 (0.96)		0.378 (0.17)	0.091 (0.30)	
OBJ	+	0.083 (0.66)	0.027 (0.70)	0.150 (0.42)	0.051 (0.59)		0.431 (0.10)	0.164 (0.20)	
PRO + OBJ	+	0.060 (0.75)		0.007 (0.75)	0.113 (0.55)	0.015 (0.55)	0.499 (0.06)		0.118 (0.06)
<i>COBIT-ITGC</i>									
PRO	+	0.053 (0.78)	0.007 (0.91)	0.089 (0.63)	0.001 (0.98)		-0.082 (0.75)	-0.023 (0.82)	
OBJ	+	0.057 (0.76)	0.017 (0.88)	0.130 (0.49)	0.058 (0.62)		0.154 (0.54)	0.011 (0.58)	
PRO + OBJ	+	0.059 (0.75)		0.01 (0.75)	0.113 (0.55)	0.02 (0.55)	0.139 (0.58)		0.01 (0.58)
<i>COSO-ITGC</i>									
PRO	+	0.394 (0.038)	0.01 (0.038)	0.323 (0.09)	0.009 (0.09)		0.303 (0.22)	0.004 (0.22)	

U univariate analysis Pearson correlation, *M* Multivariate linear regression, *S* simple linear regression, *PRO* Processes, *OBJ* objectives, *P* -value in parenthesis

more complex activity that lead to higher risks of errors over financial reporting: the ICFR Quality in this industry needs a more specialized ITC framework and, specifically, COBIT for SOX that better than COBIT is able to realize a good cost—benefit equilibrium.

Consistent with ITGC, the IT ELC compliance with COBIT for SOX (Table 6) is significantly related to ICFR Quality for the finance industry and it is not significantly related to the manufacturing and services industries. IT ELC are one of the most critical areas of ICFR, overall for the manufacturing and service industries, which often do not evaluate them. In finance industry the IT ELC compliance with COBIT are also significant (both for univariate and multivariate analysis). Banks and insurance companies, better than manufacturing and services, employ COBIT and COBIT for SOX because their compliance with the number of IT ELC objectives increases ICFR Quality.

Tests frequency (Table 7) is significantly negatively related to DA (at the 5 % level) for each industry (manufacturing and service industries, and finance industry); the negative relation shows that companies obtain high ICFR Quality if the tests execution is done more frequently, mainly every six months (the best frequency option in our questionnaire) or every three months, when companies have to communicate quarterly financial reporting to investors and other stakeholders.

In conclusion our hypothesis is confirmed in relation to industry: compliance with COSO framework in the manufacturing and service industries and with COBIT for SOX and COBIT frameworks in the finance industry increases ICFR Quality. The more tests are frequent, the more ICFR quality increases.

Table 6 COBIT for SOX and COBIT for IT ELC

Expected sign	Manufacturing and services industries				Finance industry	
	Dechow et al.		Kothari et al.		Healy	
	U	S	U	S	U	S
<i>COBIT for SOX-IT ELC</i>						
Objectives +	-0.067 (0.72)	-0.02 (0.72)	-0.010 (0.96)	-0.003 (0.96)	0.611 (0.007)	0.763 (0.007)
<i>COBIT-IT ELC</i>						
Objectives +	-0.064 (0.73)	-0.027 (0.73)	-0.007 (0.97)	-0.003 (0.97)	0.611 (0.007)	1.09 (0.007)

U univariate analysis Pearson correlation, S simple linear regression, P -value in parenthesis

Table 7 Test frequency

Expected sign	Manufacturing and services industries				Finance Industry	
	Dechow et al.		Kothari et al.		Healy	
	U	S	U	S	U	S
Test frequency -	-0.376 (0.06)	-0.019 (0.06)	-0.424 (0.035)	-0.022 (0.035)	-0.520 (0.039)	-0.051 (0.039)

U univariate analysis Pearson correlation, S simple linear regression, P -value in parenthesis

7 Conclusion

This study tests ICFR Quality in relation to companies' compliance with the COSO, COBIT and COBIT for SOX frameworks; the results show that ICFR Quality in manufacturing and service companies is significantly related to the COSO framework compliance in ITGC; this positive relation means that manufacturing and service companies could increase ICFR Quality by following the COSO framework requirements. For banks and insurance companies, the results show that ICFR Quality is significantly and positively related to the COBIT for SOX framework compliance in ITGC; these industries could improve ICFR Quality by following the COBIT for SOX requirements. The ICFR Quality in banks and insurance companies is significantly related to IT ELC COBIT and COBIT for SOX compliance. In manufacturing and services companies, IT ELC represent one of the most critical areas because they are under-evaluated in many companies. Finally, the results show that test frequency is an important aspect that could affect ICFR Quality. ICFR Quality requires periodic test sessions in ITC, and the results reveal a positive and significant association between ICFR Quality and tests frequency, with the best ICFR Quality obtained with more frequent tests (every six months in our questionnaire).

The results of this research suggest different frameworks for ITC in the manufacturing, services (COSO) and in the finance (COBIT for SOX and COBIT) industries as a condition of ICFR Quality: in a country like Italy in which there is a lack of frameworks for ITC evaluation we found that COSO could be a benchmark for manufacturing and services industry and that COBIT for SOX and COBIT could increase ICFR quality in finance industry. Consistent with Linkhous [27] and Wallace et al. [26], we found that companies employ COSO framework for ITC. Our contribution underlines that this framework increases the ICFR quality in manufacturing and services industries. Consistent with Von Solms [30], Wallace et al. [26], Greenfield [29], we found that the companies very frequently employ the COBIT framework. Our contribution underlines that this framework, together with the COBIT for SOX, increases the ICFR quality in finance industries.

This research can be useful for: (1) researchers in auditing that could compare their results with this sample and experiment this kind of model for the ICFR Quality; (2) managers and internal auditors to improve their ITCs within ICFR; (3) external auditors who must include evaluations of internal control systems in their audits.

Limitations of these results may be related to the size of the sample and to the assumption that model employed for Audit Quality could be useful for the evaluation of ICFR Quality. The model employed for finance industry could be improved. Finally we have not considered other important factors that affect ICFR Quality like PLC and ELC (we consider only the IT ELC). We also do not consider the other phases of the ICFR evaluation process (scoping, risk assessment, evaluation of control deficiencies and reporting).

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Determinants of Internet-Based Performance Reporting Released by Italian Local Government Authorities

Luigi Lepore and Sabrina Pisano

Abstract Internet has become the main channel for communication between government and its stakeholders. The study examines the determinants of municipalities Internet-based performance reporting (IPR) using the agency theory framework. The analysis was conducted on a sample of Italian cities in 2010. Our findings show that both voluntary disclosure provided via traditional channels and voluntary performance data released the previous year, as well as media interest, are significantly associated to IPR.

Keywords E-disclosure • Accountability • Local government authorities

1 Introduction

This research works explores the determinants of Internet-based performance reporting (IPR) released by Italian Local Government Authorities (LGAs) after the reform issued in 2009. This reform requires Italian LGAs to disclose performance data, in order to enhance transparency of government management. The literature examining the determinants of disclosure of financial information in public sector (PS) is largely based on the agency theory [1]. We chose to investigate performance reporting, rather than exclusively financial reporting (FR) like previous studies made, because for LGAs the financial aspect is only one dimension that

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composes the overall performance of a public institution. This means that financial concepts such as profitability, costs and revenues cannot be applied in an exclusive way to evaluate the performance of PS. The study examines the determinants of IPR and shows that both voluntary disclosure released via traditional channels and voluntary IPR disclosed the previous year, as well as media interest, are significantly associated to IPR.

2 Literature Review

The reform of Italian LGAs issued in 2009 (Law 15 and Legislative Decree 150) proposes the widespread control of LGAs' activities by citizens and other stakeholders as a tool to improve performances. The reform process starts from the assumption that to improve LGAs' performances it is necessary to ensure transparency on performances data that allows citizens to make judgments about the quality of LGAs' activities [2, 3]. The reform requires LGAs to disclose their objectives, performance indicators and data about resources spent to deliver public services, as well as information about organization. So, in order to improve PS efficiency and effectiveness it is necessary to enhance the supervision of government accounting (social control).

The remarkable progresses in the use of Internet make more easy the diffusion of information about performance and, in general, the interaction between LGAs and stakeholders. Nevertheless, IPR released by Italian LGAs is still rare. Before 2010, the diffusion of performance data was voluntary and for this reason information provided by some "illuminated" LGAs through websites was extremely heterogeneous. Alike to what happens in other countries all over the world thanks to similar reform processes or on voluntary basis, today Italian LGAs are progressively starting to disclose this information. However, research on IPR remains few and its results are very mixed. The literature examining disclosure in PS is largely based on the agency theory, in order to discover the determinants of disclosure of FR. Voters, citizenry groups, bond investors and other stakeholders are the principals and political managers are the agents. There are, however, also several other theoretical approaches that have been used to investigate these phenomena, including legitimacy theory, political processes, property rights. We address prevalently to the agency theory, because it better explains the asymmetry between LGAs and stakeholders that inhibits the social control.

Laswad et al. [4] examined the possible determinants of discretionary Internet FR of LGAs in New Zealand in the context of agency and other theories. They found that both LGAs size and level of political competition are not useful predictors of Internet FR. Instead, LGAs that are highly leveraged or that create relatively more municipal wealth than other LGAs are more likely to engage in Internet FR. Moreover, LGAs that are more visible in press are also more likely to use Internet to offer financial information. Likewise, city and regional councils engage in more discretionary Internet FR than district councils. Differently, Groff

and Pitman [5], investigating government financial information on websites provided by 100 biggest cities in U.S., found that size is a determinant of e-disclosure, like the condition of debt financing. Also Jorge et al. [6] found that size affects e-disclosure in the Italian and Portuguese contexts. In the same way, Styles and Tennyson [7] investigated publication on Internet of government financial information of 300 LGAs in U.S. and found that size, per resident income and the quality of disclosure of financial information determinate whether a LGA presents its financial information on website, while size, per resident income, ratio of debt, and financial condition are the determinants of the accessibility of financial data on Internet. Yu [8] investigated the content and accessibility of e-disclosure of financial information of LGAs in China and found that size, wealth and type of LGAs are significantly associated to the extent of Internet based FR, while size, income country, financial condition and type are significantly associated to the accessibility of e-disclosure of government financial information.

According with Laswad et al. [4], Serrano et al. [9] showed that Spanish LGAs characterized by both higher citizens' economic levels and greater media pressure, measured as internet visibility, disclose financial data online. However, they also found that both LGAs size affects e-disclosure and LGAs efforts to implement e-government influence the publication of data via Internet. Relatively to Spanish LGAs, García and García-García [10] used two regression models to test different hypotheses regarding the relationship between voluntary financial e-disclosure and some determinants. They found that size, investment and political competition significantly increase the likelihood of reporting financial information through website. In this way, they confirmed some of the results found by Serrano et al. [9]. Moreover, they found a negative relationship between press visibility of the municipality and the degree of online reporting, when they measured the dependent variable as a weighted sum of specific items identified *ex ante*, rather than as a dummy variable.

Differently from other studies cited above, the Authors hypothesized a negative relationship between press visibility and e-disclosure because, according to Zimmerman [11], they agree, on one hand, that media play a moderating role in the agency relationship between voters and local governments, influencing the degree of online reporting, but they also agree, on the other hand, that the monitoring provided by press does not insure that the elected officials will operate in the best interests of their constituency, because press does not necessarily act on behalf of citizens. In other words, media prefer to publish only the news, like scandals, corruption, budget deficits, that increase their circulation, because they have their own financial objectives to pursue.

3 Hypotheses and Research Design

We grouped the factors which lead LGAs to disclose performance data on Internet into two dimensions. The first one represents the institutional characteristics and corresponds to the first four hypotheses through which we analyze the relationship

between IPR and Size, Financial Autonomy, IPR released in the previous year and Voluntary Disclosure. The second one represents the environmental setting and includes four hypotheses through which we link IPR with characteristics such as Internet Visibility, Press Visibility, Media Interest and Citizens' Wealth.

There exist numerous theoretical arguments and empirical studies [4, 5, 7–10] which predicted and tested a positive relationship between size and disclosure. According to the agency theory, conflicts of interests between LGAs and their stakeholders are more likely in larger municipalities and the provision of information is more helpful for them than for small cities [11]. Thus, larger LGAs will disclose more information via Internet in order to meet the higher demand of information by citizens and institutions. So, we hypothesize that:

H₁ Size is positively related to IPR

A number of studies [4, 7, 8, 12–14] considered the relationship between some measures of municipalities' financial condition and accounting disclosure, obtaining mixed results. The idea is that financial condition signals the ability of LGA management. So, poor LGAs may have disincentives to disclose financial information and, in general, performance data. We use financial autonomy as a proxy of financial condition and hypothesize that:

H₂ Financial Autonomy is positively related to IPR

Voluntary disclosure of LGAs represents a proxy of LGA transparency. Voters and other stakeholders use information disclosed to monitor LGA managers' performances. These managers use disclosure to signal their performances to the principals, reducing information asymmetry. Thus, we hypothesize that LGAs oriented toward increasing transparency are more interested in disclosing performance data via Internet, and so that:

H₃ Voluntary Disclosure is positively related to IPR

In the same vein, considering that during 2009 the release of IPR was voluntary, we hypothesize that:

H₄ IPR_{t-1} is positively related to IPR

Citizens with higher income per capita expect more services and performance data [12, 15], moreover they generally have more access to and experience to use Internet [7]. Both higher demand for LGA accountability and greater use of Internet by citizens with higher wealth suggest that:

H₅ Citizens' Wealth is positively related to IPR

Press, and more in general public media, has an important role in influencing the agency relationship between voters and politicians [11, 12]. A strong influence exerted by public media might induce more disclosures and the communication conveyed by media can be used as a defensive mechanism for politicians. Results obtained by previous research are mixed. Moreover, someone [10] hypothesized a negative relationship between press visibility and e-disclosure, considering that the monitoring provided by press does not insure that the elected officials will operate in the best interests of citizens. We hypothesize that:

H₆ Press Visibility is negatively related to IPR

H₇ Internet Visibility is negatively related to IPR

Considering the mixed results of previous studies, we decide to measure also the degree of media interest perceived by each municipality. In fact, it is not the real pressure exerted by press to persuade politicians to increase disclosure, but rather the internal perception of that pressure. So, the following hypothesis has been formulated:

H₈ Media Interest is negatively related to IPR

We empirically test the previous hypotheses on a sample of 167 Italian municipalities (IMs) in 2010. Our sample is composed of all IMs which responded to a questionnaire that we sent during 2011 in order to collect data on our variables. We chose to investigate IMs because they are responsible for the provision of the most immediate public services to citizens. In this sense, it is important to examine how many information they release about their performances. We decided to analyze the information released in 2010 because the reform required IMs to disclose performance data starting from this year. We used the questionnaire to collect data on IPR released during 2010 and the previous year (IPR_{t-1}), Voluntary Disclosure (*VolDisc*) and Media Interest (*MedInt*). The information on Size (*Size*), Financial Autonomy (*FAut*) and Citizens' Wealth (*CiWeal*) was collected from the ANCI website. Finally, data on Press visibility (*PressVis*) and Internet Visibility (*IntVis*) were collected from Google. To test our hypotheses we used the following OLS regression model:

$$IPR = \alpha + \beta_1 Size + \beta_2 FAut + \beta_3 VolDisc + \beta_4 IPR_{t-1} + \beta_5 CiWeal + \beta_6 PressVis + \beta_7 MedInt + \beta_8 IntVis + \beta_9 Geo + \beta_{10} EPres + \varepsilon \quad (1)$$

This econometric model investigates the influence of the independent variables identified on IPR released by IMs. To measure our dependent variable, we developed an unweighted disclosure index. The research method was organized as follows. Firstly, we selected the performances data that IMs should disclose on Internet on the basis of the reform issued in 2009. We identified 11 items that mainly concern outcome, output and processes measures, as well as information about the organization. Then, we inserted this performance information in the questionnaire sent to IMs and collected data for each item. A score of 1 was assigned to each item if the IM affirmed it was disclosed, and a score of 0 otherwise. The final score assigned to each IM was measured by an index, which varies from 0 to 1 and is equal to the ratio between the number of items released and the total amount of items identified ex ante. We considered eight independent variables. Firstly, we analyzed *Size*, measured as the number of IM inhabitants [9, 10]. Moreover, we investigated *FAut*, calculated as the ratio between revenues obtained from local taxes and tariffs to total current revenues. If this ratio is high, it means that IM is little dependent on other public administrations for sources of financing. *VolDisc* was computed as the number of voluntary reports drawn up by each IM. IPR_{t-1} was computed as our dependent variable but for the previous year (2009). *CiWeal* was measured as the disposal income per IM inhabitant [8, 9]. *PressVis* was calculated as the number of items in the print press in which IM appeared during

2010 by a count search on Google [4]. *MedInt* was computed using a 4-point scale varying from 0 to 3 according to the degree of media interest perceived by each IM. Finally, *IntVis* was measured as the number of incoming links to IM website according to Google [9]. To isolate the relationship between IPR and independent variables, we included Geographic Location (*Geo*), measured with dummies variables for 5 areas: South, Island, Centre, North-East, North-West [16], and E-Presence (*EPres*), computed using a 3-point scale varying from 1 to 3 according to the period (recently or some years ago) in which IM implemented website [17], as control variables. Both these variables were collected using the questionnaire.

4 Results

Table 1 provides descriptive statistics. The IMs investigated are mainly small: the average *Size* is 10,713.35 inhabitants. Moreover, these IMs present medium levels of *FAut*: on average 61% of current revenues is obtained from local taxes and tariffs.

Passing to IPR, it emerges that the IMs investigated released 54% of the performance data identified on average, that is equal to 6 items. Moreover, only one IM provided all the information identified ex ante. However, compared with IPR_{t-1} it emerges that the IMs analyzed increased the performance data released. In fact, the previous year they disclosed only 24% of the information on average, equal to just 3 items. This means that IMs increased the performance data provided on Internet after the reform. *VolDisc* is very low: the 74% of the IMs analyzed does not draw up voluntary reports. The rest of the sample prepares at most 3 documents, that are mainly social accountability reports. Passing to the environmental setting variables, both *PressVis* and *IntVis* present low values (16.18 and 11.40). These findings could be due to the dimension of the IMs included in the sample. In other words, it could be that media are not very interested in the events occurring in smaller IMs.

Table 1 Descriptive statistics

Variables	Mean	Std.d.	Min.	25th Pct.	50th Pct.	75th Pct.	Max.
IPR	0.54	0.19	0.00	0.45	0.54	0.63	1.00
<i>Institutional characteristic</i>							
Size	10,713.35	11,932.53	533.00	4,018.00	8,341.00	12,574.75	90,288.00
FAut	0.61	0.13	0.11	0.52	0.63	0.71	0.86
VolDisc	0.36	0.64	0.00	0.00	0.00	1.00	3.00
IPR _{t-1}	0.24	0.12	0.00	0.18	0.27	0.27	0.63
EPres	1.83	0.70	1.00	1.00	2.00	2.00	3.00
<i>Environmental setting</i>							
CiWeal	23,040.10	19,287.92	14,747.00	18,691.75	20,408.00	22,322.00	233,730.00
PressVis	16.18	75.43	0.00	1.00	4.00	10.00	926.00
MedInt	0.91	1.00	0.00	0.00	1.00	2.00	3.00
IntVis	11.40	13.60	0.00	4.00	7.00	14.00	92.00

Table 2 Results from OLS regression

Dependent variable: Internet-based performance reporting			
Variables	Predicted sign	Estimated coefficient	T-statistic
<i>Institutional characteristic</i>			
Size	+	0.084	0.807
FAut	+	0.054	0.533
VolDisc	+	0.201	2.438
IPR _{t-1}	+	0.260	3.218
EPres	+	-0.117	-1.399
South	±	-0.283	-2.740
Island	±	0.043	0.376
Centre	±	-0.156	-1.505
North-East	±	-0.039	-0.391
<i>Environmental setting</i>			
CiWeal	+	0.020	0.253
PressVis	-	-0.037	-0.364
MedInt	-	-0.201	-2.508
IntVis	-	0.110	1.097
Observations	167		
R ²	0.223		
Adjusted R ²	0.146		
F-statistic	2.875		

a=p<0,05
b=p<0,01

However, the low value of *MedInt* (0.91) means that the IMs studied consider media to be not interested in their performances.

Table 2 shows findings from OLS regression. The results provide support for hypotheses H₃, H₄, H₈. We found a positive relationship between both *VolDisc* and IPR ($\beta = 0.201, p<0.05$) and *IPR_{t-1}* and IPR ($\beta = 0.260, p<0.01$). The findings also show a negative association between *MedInt* and IPR ($\beta = - 0.201, p<0.05$). However, considering the adjusted R², the model explains a mild proportion of the variation in IPR.

5 Discussion and Conclusions

This study has investigated the determinants of IPR released by LGAs using the framework of the agency theory. Our analysis among IMs provides partially support for the hypotheses developed. As expected, the results support the hypothesis stating that *VolDisc* was positively associated to IPR. In other words, IMs that are more oriented toward increasing transparency provided more performance data. This result is in line with the assumptions of the agency theory, that considers the provision of voluntary disclosure as a mechanism useful in reducing the information asymmetry between principal and agent [1]. This result is also

justified by the typology of report prepared. In fact, if we analyze the voluntary reports drawn up by the IMs investigated it emerges that they are mainly social accountability reports. The characteristic of these documents is that they require the participation of external stakeholders, mainly citizens, to be drawn up. So, IMs that prepare these reports are more oriented toward transparency and, as a consequence, decided to release more performance data. Moreover, the results support the hypothesis stating that IPR_{t-1} was positively associated to IPR. This finding means that the more the performance data provided during 2009, the more the performance data released in 2010. In other words, the IMs that disclosed IPR the previous year provided the same or more items during 2010, when the release of this kind of data became mandatory. Considering that during 2009 the provision of performance data was voluntary, this finding is linked to the previous one and can be explained using the same considerations related to the agency theory.

Contrary to our expectations, the results do not support the hypotheses assuming that both *PressVis* and *IntVis* were negatively associated to IPR. As stated above, this could be due to the dimension of the IMs included in the sample. However, if we consider the degree of media interest perceived by each IM, the findings support the hypothesis stating that *MedInt* was negatively related to IPR. This result is different from those of previous researches showing a positive relationship between press visibility and voluntary Internet FR [4] or finding that, on average, LGAs which disclose financial information are more visible on Internet [9]. On the other hand, our finding is in line with those which found both a negative relationship between newspaper circulation and disclosure quality of FR [12] and a negative association between press visibility and e-disclosure [10]. The negative relationship between *MedInt* and IPR should be interpreted in different ways. A first explanation for our finding could be that LGAs consider the press as a substitute for disclosure via Internet [12]. In this sense, IMs decided to not provide performance data on Internet because they elected to have information disclosed through the press rather than through their website. However, an alternative explanation for our result could be that IMs perceive media as interested mainly in news presenting scandals and corruptions [11], that LGAs do not want to report through their website. As a consequence, the more the media interest perceived by IMs, the lower the items of information released. This justification seems to be more reliable, considering also the findings of the descriptive statistics. In fact, it is more likely that IMs, which consider media to be not interested in their performance, perceive that press is mainly interested in scandals and corruptions and decide to defend themselves by disclosing less information via Internet.

Finally, the results show that IMs located in the south Italy are associated with lower levels of IPR. A possible explanation for this finding could be that south cities present financial conditions worse than those of cities located in other Italian regions. As a consequence, south IMs do not give much attention to IPR because they do not have the resources necessary to support this function.

Our findings should be of interest to both academics and regulators. From the academic perspective, the research contributes to previous studies on the determinants of Internet-based disclosure by analyzing the information released on

performance data, rather than exclusively the financial information, in the Italian context. From the regulator's perspective, the findings of this research could be useful to the Italian legislator by providing insights on the items of information that are less disclosed by IMs after the reform and, consequently, on performance data that should require some improvements. However, the mild proportion of the variation in IPR explained by our model means that it is necessary both to include other variables in the regression and to extent the analysis to other IMs. With regard to the last point, it is important to highlight that this study presents the results of the analysis conducted on the IMs that responded to our questionnaire. However, we are seeking to have the other questionnaire back, in order to perform the analysis on a greater sample. Moreover, we are collecting data on political factors. In fact, as previous studies showed, municipal policy is an important determinant of the information disclosed via Internet.

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Mandatory Compliance in Transparency of Public Administration

Massimo De Angelis and Maria Guerra

Abstract The Italian legislator has acted as a promoter to develop a new culture in the public sector oriented to transparency and to stakeholder engagement. Public institutions (PA) have been stirred to publish a wide range of institutional data on their website to allow citizens to be aware of the activity carried out by these institutions and to monitor how public funds are used (accountability). The aim of this research is verify if PA are comply with the law on transparency. The research shows that a better level of transparency is achieved when it is required by law, but the requirements not directly connected with law, such as suggestions to promote usability and interactivity of website, have a low level of accomplishment.

Keywords Transparency • Public administration • Public institutions • Accounting information systems • Website • Mandatory compliance • Decree 150/2009

This research work is carried out by both authors; however the paragraphs 2 and 3 can be attributed to M. Guerra, paragraphs 5 and 6 to M. De Angelis, paragraphs 1 and 4 to both authors.

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1 Introduction

In Italy, in the last few years the public institutions have been the subject of legislative measures aimed at increasing the transparency and accountability of management processes. Recently the most significant regulatory intervention is represented by Legislative Decree 150/2009.

This decree aims to introduce an evaluation system of performance in the public administration in order to ensure high quality standards of services, to reward worker performances and to encourage transparency on activities carried out by PA. The concept of transparency is defined as total access of citizen to the performance evaluation system and to information concerning PA activities and every other organizational aspect, also through data provided by websites: the aim is to allow citizen to evaluate impacts and costs of PA.

In this article the survey focus is on Title II, denominated “Measurement and evaluation of performance and transparency” of the decree, to analyse the compliance of PA websites with the requests disposed by article 11 (Titled “Transparency”) of decree 150/2009, in terms of information to be published.

The authors analyse the compliance of PA with decree 150/2009 through the observation of their websites. This study is conducted in relation at two different aspects of transparency: “content website analysis”, namely type of data published and “technical website analysis”, namely the set of tools making data usable by citizens (format data, website functions and so on).

The article 11 states that PA have to publish within their institutional website an informative data series regarding “every aspect of the organization, the indicators relating to the performance management and use of resources for the pursuit of official duties, the measurement and evaluation of performance realized by competent structures”.

In order to carry out this analysis, in addition to the mentioned decree, the authors have followed the Resolution 105 of October 14, 2010, deliberated by the “Independent Commission for the Assessment, Transparency and Integrity of Government” (CiVIT). The resolution is a guideline that describes how to draw up the Three-year program for the transparency and integrity, adds data to be published on the website to improve comprehensibility and identifies procedural requirements for on line data publication. The authors considered Italian ministries as survey sample because in charge of supervising Italian public entities. In order to evaluate the adaptation of web sites, the authors have used a modified version of the “pattern” attached at CiVIT resolution 105/2010.

Although the heterogeneity of information required by decree and by resolution is high, the result is that ministries are not fully compliant with law and guidelines.

The paper is structured as follows: [Sect. 2](#) presents briefly the concepts of transparency and makes a summary of transparency law in Italy; [Sect. 3](#) analyses literature review on the determinants of transparency; [Sect. 4](#) addresses the methodological issues, firstly presenting the variables analysed, including how

they have been defined, then establishing the hypotheses, and finally describing the sample, model and analysis procedures; [Sect. 5](#) presents the main findings, clusters analysis, and [Sect. 6](#) summarizes the conclusions.

2 Italian Law Analysis

The Italian government promotes transparency in order to increase PA accountability, eliminating waste and inefficiencies. The decree 150/2009 and the resolution 105/2010, recently adopted, have the purpose to implement transparency through appropriate tools such as new information technologies. Information published on line must be complete, useful to understand the meaning of data, reliable, readily available and usable.

Based on article 11 of decree 150/2009 data to be published have to refer to the organization, management and to the administrative activity results. The objectives are to promote transparency to enable citizens to monitor activities and expenses of PA.

Transparency is defined as “total access, also through on line publication of data (information regarding the organization, the results of measurement and evaluation performance realized by competent structures) in order to encourage control on good governance rules and impartiality”.

The decree provides some tools to implement and ensure an adequate level of transparency, legality and integrity, such as the “Three-Year Program for the Transparency and Integrity” and the “Performance Plan and Reports”. According to the decree and to the resolution, PA must ensure maximum transparency in every phase of the cycle of performance management. To this end, annually the PA have to identify the services provided to final and intermediate users. Public institutions have also to publish on their institutional websites data about actual and labour costs for each service provided.

Paragraph 8 of article 11 contains a list of information (see [Table 1](#)) that each public institution must publish on its corporate website, in an easily accessible section entitled ‘Transparency, evaluation and merit’ (the article 11 is linked to the decree 82/2005 and Law 241/90 and 69/2009).

This list of information to be published is a minimum and general content. The law doesn’t give any specific instructions on how to publish data. For example, there are not instructions how to structure the section “Transparency, Evaluation and Merit” and no suggestions are given how to facilitate access and consultation of data published on websites.

The resolution CiVIT 105/2010 contains guidelines which integrate some aspects of the decree. It explains the concept of transparency and the goals want be achieved by the Italian legislator. The resolution indicates form and content requirements of the the “Transparency” section and specifies the information that must be included, with the illustration of examples. The concept of transparency described by decree it is inspired to the “open government” of U.S. origin. Transparency represents for the citizen a demand to participation to decision

Table 1 Requirements requested by decree 150/09

Section dedicated to transparency for each corporate websites of PA
Three-year program for the transparency and integrity and its implementation
Status of implementation of the three-year program for the transparency and integrity (semiannual)
Performance Plan
Informative on organizational data (organization chart, offices, name of chief manager offices)
Email list of the top management and of chief manger offices (certified email must be highlighted)
Proceedings list running in the PA (for each proceeding must be indicated: timing within the proceeding must be concluded, manager in charge of monitoring the proceeding)
Modality and deadline to apply for each proceeding involving stakeholder
Curricula of the holders of organizational positions must be written according to the EU format
Curricula, wages of managers (including the performance award)
Curricula, wages and rewards of the persons who hold political-administration position
Curricula and wages of the members of the independent evaluation unit (O.I.V.)
Absence rates and greater presence of personnel
Total amount of bonuses allocated to the performance and the amount of premiums actually distributed
Analysis of data on the degree of differentiation in the use of reward, both for managers and employees
Codes of conduct
Data on economic and financial management of public services: such as services provided to end users and intermediate users
Integrative contracts concluded, including financial and technical reporting certified by control organism authorized
Indicator of the average time of payment for the purchase of goods, services and supplies
Data on “best practices” about proceedings timing and public services delivery

process of PA activity; for the PA it is an instrument to improve the resource management thanks to the involvement and participation of the stakeholders.

The resolution has extended the concept of transparency: it represents a “two way communication” that is realized through usability and interactivity of website. These two concepts are not explicated in the decree which indicates just what data must be published on the website of PA. The elements described in the resolution 105/2010 may improve comprehensibility, usability and interactivity of website. The requirements requested by resolution are collected in the Table 2. Full Transparency is achieved when the requirements indicated in the Tables 1 and 2 are respected.

3 Literature Review

The main objective of the Italian reform on transparency is to reduce the information asymmetry in order to allow citizens to evaluate PA performance. Moreover, the reform promotes citizen involvement in the decision-making process in

Table 2 Transparency according to CiVIT

How section “Transparency, Evaluation and Merit” should be structured (homepage): the section must have a tree data structure
Timeliness of data publication (date of updating documents)
Which should be the format of data published on websites: “eXtensible Markup Language”—XML, “Open Document Format”—PDF
Presence of tools for update notification: RSS
Presence of tools to get stakeholders feedback: email
Previous programs for the transparency and integrity (including a related status of implementation)
Summary overview of the program of transparency
Information about quality of public services delivered
Quality chart (to allow the monitoring of services delivered by PA)
Financial and economic data regarding consortia, organizations and companies
Web access to the register of beneficiaries of economic providence
Data about public procurement

order to improve PA activities. The reform is based on the idea that transparency is not only the publication of the data but also a tool to achieve a two way communication between public administration and citizens [1, 2]. The diffusion of internet and web technologies make possible to implement principles provided by reform. In particular, internet offers a several of advantages, including the following: disclosure of data on corporate websites, information accessible to a greater number of users at a lower cost, constant on-line reporting, organizations accountability and performance evaluation, information more comprehensible for users, interaction between PA and citizens [3–13]. On-line disclosure has also some risks such as difficulty of access or navigability, dispersion or overloading of information on websites [3, 4, 9, 12, 14, 15]. These limits have a negative impact on the achievement of transparency in the web. For this reason, the evaluation of transparency, realized through web, has to include three aspects: content, design and functionality. Content refers to the information published in the website, design refers to the way the content is made available for web user [16]. Functionality refers to features that improve website performance. It includes usability and interactivity. Usability represents the “easy access” to information for user and navigability in the web portal. Interactivity represents the degree of feedback and “iterative communication” between PA and citizens [6, 11, 17]. In literature many studies use a conceptual model that differentiates website content from design [6, 9, 16–18]. This model is used to analyze corporate web sites in relation to different objectives of study [4, 18–22].

In the literature, transparency is analyzed in relation to different aspects. The main studies on transparency can be divided into two stream of research: the first analyzes the impact of transparency on users (especially in relation to trust and satisfaction) [3, 11, 23–28]; the second analyzes the importance of the web as a tool to realize transparency [4, 6, 17]. Few studies were found on compliance with transparency [29–32]. Transparency is a complex issue because of the different

targets to achieve and because the way to get transparency is difficult: to achieve transparency it is required an integrated and structured information systems and it is required as well a technically advanced websites (website maturity/technical sophistication) [6, 17]. It's a dynamic concept because it requires a continuous updating of data in the web and an open dialogue between citizens and the PA. Not analyzing the different issues that transparency involves could lead to failure of the related laws [7].

In order to implement transparency the PA has to decide what information to provide and disclose and how to communicate this information to citizens [33]. The information selection that allows citizens to know PA performances without overloading the web and generating confusion is an essential and critical point. "Pseudo transparent" situations, by publishing a large amount of information or difficult to comprehend [3, 14] should be avoided. The transparency is measured not only by quality and quantity of information, but also with "depth of access" [2, 34, 35]: the authors sustain that the information generated by AIS allow to monitor PA activity.

In relation at content, some researchers, sustain that transparency is achieved through disclosure of reliable information about administrative processes, decisions, activities, outputs, and outcomes [35]. For some researchers [36], the transparency is realized with disclosure on the web of information related at budgetary, financial indicators and expenditure. For other researchers is necessary to publish information about performance of services provided [37]. Liem [33] sustains that transparency should be defined according the following dimensions: administrative services, processes (input–output decision making process), organizational information (organization charts, allocation of duties, job description). The selection of information to be published is crucial: information must be reliable and useful for citizens, without excessive cost. The disclosure in web of financial information and non is essential to know overall activity of PA. Researchers sustain that the aim of transparency is to make efficient the PA and to explain how public funds are spent. Therefore, researchers consider five main areas: rules and regulations, services provided, organization and performance. This last category may include expenditure, contracts and supplies, performance of human resources, goals and achievements, payments, financial indicators.

Most of the literature [3, 6, 11, 14, 17, 33, 36, 38, 39] agrees in considering the web as a necessary tool to achieve transparency. "The more transparent an organization's website is, the more the organization is willing to allow citizens to monitor its performance" [11, 39].

Website represents an important channel of communication between the PA and citizens, in order to reduce the information gap and to encourage the involvement of stakeholder in decision making. Transparency through web assumes new requirements: comprehensibility, timeliness, interactivity (participation) and usability (involvement). Comprehensibility refers to simplicity and clarity of information [3, 14]. Timeliness refers to updating of the information published [3, 14]. If it is not possible to publish information in real time, the PA

shall provide “regular reports” so that the stakeholder is able to monitor its performance over time [3, 14].

The concepts of usability and interactivity have been widely debated in the literature. The authors consider useful the studies conducted by Pina et al. [17], Searson and Johnson [6], Pérez et al. [9], and Yuan et al. [18]. These studies underline that the potentialities of the websites, in particular the interactivity, are important to allow the citizens to participate in the decisional making process of PA. The latter, often, use the website as “one way communication”, instead for the authors it is necessary to develop a “Two way communication”. The participation to the PA activities, it allows the stakeholders “to be creators of content rather than just passive recipients, and active participants in dialogue instead of just bystanders” [11].

Pina et al. [17] propose a model to examine the level of e-government in 15 countries of EU. They adapted the model Website Attribute Evaluation System (WAES) to their study, removing some items and introducing new ones. This model is based on four different dimensions: transparency, interactivity, usability and website maturity. The sample refers to websites regional and local governments. Items used to evaluate transparency refer to the type of data published (content analysis). Items used to evaluate interactivity are: e-mail, forum, update announcements or newsletters and so on. Pina et al. sustain that transparency and interactivity reflect the degree of openness of government websites. Usability is evaluated with following items: FAQs section, specialized databases, uniform layout and so on. Website maturity refers to aspects that indicate a high degree of website sophistication, such as no broken links, audio or video files and so on. They use Multidimensional Scaling Technique in order to determine whether there are significant differences between countries. The study, differently from this chapter, is based on questionnaires sent to the sample selected. Moreover, their analysis is not based on a specific law on transparency. However, this study can be useful for the authors because suggests a model of analysis that includes the different dimensions of transparency.

Searson et al. [6] propose a model to evaluate web features that impact on “two way communication”. They sustain that government website is a fundamental tool to achieve transparency. They also argue that “two way communication” is important to create an interactive relation between citizens and PA. “Two way communication”, in particular interactivity, and disclosure on the web are key indicators of transparency. Their model is based on three dimension: usability, interactivity, and technical sophistication of websites. Interactivity includes features such as forums, blogs, chat rooms and telephone numbers. Usability includes features such as search bar, font-adjustment option, frequently asked question section and so on. Technological sophistication refers to advanced features such as graphics and availability of moving images (e.g., flash films, videos, and/or YouTube). Searson et al. classify government website in relation to number of features present in web as follows: LOW, BASIC, or HIGH. HIGH sophistication refers to sites that utilize many features. These sites include higher disclosure of information (transparency) and two-way symmetric conversation. BASIC sites

employ some features but not all. LOW sophistication refers to sites that have a low use of these features. Generally, LOW sites include sites with little information. This research, unlike Pina et al., considers countries with and without law on transparency. This study is useful to classify PA websites in relation to the level of sophistication achieved. In particular is useful to understand whether PA adopts web features that allow to implement “two way communication” and improve interactivity.

Pérez et al. [9]. proposes a model to analyze citizens’ access to on-line governmental financial information. This model considers three dimension: content of the information to be included on the website; fulfilment of certain qualitative characteristics; and design and navigability of the website. Content of the information refers to type of financial information disclosed on-line. Second dimension refers to characteristics for digital governmental financial reporting: completeness of the accounting information; timeliness; understandability or clarity; comparability; relevance; and reliability. Third dimension refers to six key aspects of website design: easily identifiable information (site map, specific section); personalization of the information (different user profiles), ease of transit through the information, ease of management of the information supplied, different languages to disclose the information, ease of interaction with the users of the information (mailing lists). They sustain that users should have the opportunity of downloading on-line information in a variety of formats. So users can manipulate, combine, or summarize governmental information as deemed appropriate. Use of formats as Microsoft Excel, instead that .html formats (Hypertext) or text files, .pdf (Adobe Acrobat), or .doc (Microsoft Word) enable interactions with the information. Pérez et al., in according with Searson et al. [6], consider interactivity an important instrument to create “two way communication”. Similarly to this chapter, the items included in the three dimensions mentioned above are evaluated on a binary scale, depending on whether the websites meet the requisite or not. Also this study, such as the finding of Pina et al. [17], is not based on a specific law on transparency. They consider only financial reporting, ignoring other governmental information. However, it is possible to underline some items useful to evaluate transparency. Researchers consider “specific section” and “format excel” two important items to evaluate usability. According with literature analyzed, interactivity represents a key indicator of transparency.

Yuan et al. [18] proposes a model titled “Government Portal Performance Architecture” (GPPA), based on the theory of web quality evaluation and the contemporary public administration principles. In particular, they check whether the Chinese government websites are ready to adopt the principles of contemporary public administration. They consider transparency such as a service delivered by government. Therefore, the transparency can be evaluated in the same way as other services offered by PA. The model proposed considers three dimensions: content, construction, and function. Content includes the following indexes: information transparency and e-information. Function includes: availability of services, level of sophistication, functionality, interactivity, e-consultation and e-decision making. Construction includes: Web design, user friendliness, page

Table 3 Factors affecting usability and interactivity of websites

<i>Usability</i>	Font adjustment, print format, search bar, FAQ section, sitemap, press room, link to other related sites, visual clutter, other language, glossary, sitemap, A to Z index, FAQ, search engine, access to specialized databases, homogeneity of the different sub-pages, on line facilities for disability
<i>Interactivity</i>	Blogs, forum, petitions, spot polls, surveys, transparency policy, email address, telephone number, physical address, comment form, automatic update announcement or newsletter via subscription

download time, available bandwidth, latency, packet loss. This model seeks to combine two type of analysis on e-government. First type of analysis is based on presence or absence of certain services or features of e-government; second type of analysis is based on perception of people about the quality of e-government. Another merit of this study is the involvement of IT experts to evaluate websites. The model proposed, for complexity and type of items used, is more suitable to evaluate e-government.

The Table 3 includes some features of usability and interactivity. Italian literature considers reform on transparency a fundamental step to improve PA performance and realize an interactive relation between PA and citizens [40–44].

Brancasi et al. [45] consider that accounting is a precondition to achieve the transparency. Data produced by accounting and connected to the resources administered by PA allow to understand in which way resources are acquired and employed. The publication of the data produced by the accounting office (financial data, economic data, etc.) allows citizens to monitor how public funds are spent. Accounting elaborates simple data and realizes informative objects that can increase participation and awareness of the citizens about the management of public resources. Brancasi explains that “Accounting is therefore a precondition for transparency because it creates data that, once made public, they are the subject of analysis. [...] the data type depends on the type of accounting. [...] transparency in the management of the PA may have a different content depending on the choices made in the definition of the accounting system”.

Government reports on transparency in the years 2009, 2010 and 2011 [46–49], show that compliance with decree and resolution is very low. In effect, It will take many years for PA to be compliance with decree. Another risk in adopting reform by PA, is the formal compliance while the principal aim of decree is to improve public administration [42, 43].

Comply with mandatory requirements it is generally not immediate and it may requires some conditions; the legislator needs to know what context variables it is necessary to manage in order to get the most virtuous behaviors by PA adopting law requirements [50, 51]. Introduction of stringent enforcement mechanisms and continuous reporting on transparency may be useful tools to improve compliance to transparency reform in PA [52, 53].

4 Framework for Analysis of Compliance and Methodology

The study analyzes the degree of transparency achieved by PA according to the requirements defined by decree 150/2009 and the resolution CiVIT 105/2010.

The survey sample is composed by thirteen ministries. The methodology has been applied to the Italian ministries considering their role of supervising Italian public entities. Data-gathering was conducted through a survey of published data on PA websites. Data were gathered in May and the operation lasted seven days. In line with other similar research [14, 54] conducted on content analysis of websites, has been used the binary code: “0” means the requirement is not accomplished; “1” means the requirement is accomplished.

To collect data the authors have used a modified version of the “pattern” attached at CiVIT resolution 105/2010.

The collected data were organized in 2 subsets (subset A and B). The Subset A) consists of 20 items useful for assessing the compliance of PA with the decree 150/2009 (see Table 1). In particular the question “published data?” was applied to the Table 1 to evaluate the compliance with the decree 150/2009. The index of compliance with the decree is the percentage of achievement of the requirements.

The subset B) consists of 29 items useful to evaluate the compliance of PA with the resolutions 105/2010. The items of Table 1 have been integrated with the items of Table 2 to evaluate the compliance with resolution. The compliance with the resolution is based on the percentage of data published as required by CiVIT to improve comprehensibility and it is based on the performance percentage of usability and interactivity of websites.

The following four questions—1 *Update data is indicated?* 2 *Data are published in open format?* 3 *Tools for update notification are indicated?* 4 *Tools feedback are indicated?*—were applied to the items listed in the Table 4 to determine the performance percentages of usability and interactivity of websites.

Considering that all the requirements (data published, usability and interactivity) contribute equally to determine the compliance level with the resolution 105/2010, the index of compliance with the resolution is the arithmetic average of the performance requirement percentages achieved.

The transparency level of PA (high, mid, low) is determined by the index of compliance with the decree 150/2009 and by the index of compliance with the resolution CiVIT. The Fig. 1 explains the methodology to detect the degree of transparency.

5 Analysis of Data

The following figures and tables have been developed to better interpret the analysis results.

Table 4 Evaluation of usability and interactivity

	Usability		Interactivity	
Description	1) Update data is indicated	2) Data are published in open format	3) Tools for update notification are indicated	4) Tools feedback are indicated
	Yes/Not	Yes/Not	Yes/Not	Yes/Not
1	Area dedicated to transparency for each corporate websites of PA easily accessible			
2	Three-year program for the transparency and integrity and its Implementation			
3	Status of implementation of the three-year program for the transparency and integrity (biannual)			
4	Performance Plan			
5	Informative on organizational data (organization chart, offices, nominative of chief manager offices)			
6	Email list of the top management and of the chief manger offices (certified email must be highlighted)			
7	Proceedings list running in the PA (for each proceeding must be indicated: timing within the proceeding must be concluded, manager in charge of the proceeding)			
8	Modality and deadline to apply for each proceeding involving stakeholder			
9	Curricula of the holders of organizational positions must be written according to the EU format			
10	Curricula, wages of managers (including the performance award)			
11	Curricula, wages and rewards of the persons who hold political-administration position			
12	Curricula and wages of the members of the independent evaluation unit (O.I.V.)			
13	Absence rates and greater presence of personnel			
14	Total amount of bonuses allocated to the performance and the amount of premiums actually distributed			
15	Analysis of data on the degree of differentiation in the use of reward, both for managers and employees			
16	Codes of conduct			
17	Data on economic and financial management of public services: a) services provided to end users and intermediate users			
18	Integrative contracts concluded, including financial and technical reporting certified by control organism authorized			
19	Indicator of the average time of payment for the purchase of goods, services and supplies			
20	Data on “best practices” about proceedings timing and public services delivery			
21	How Section “Transparency, evaluation and merit “ website should be structured (homepage): the section must have a tree data structure			
22	Previous programs for the transparency and integrity (including a related status of implementation)			
23	Summary overview of the program of transparency			
24	Previous status of implementation of the three-year program for the transparency and integrity			
25	Information about quality of public services delivered			
26	Quality chart (to allow the monitoring of services delivered by PA)			
27	Financial and economic data regarding consortia, organizations and companies			
28	Web access to the register of beneficiaries of economic providence			
29	Data about public procurement			

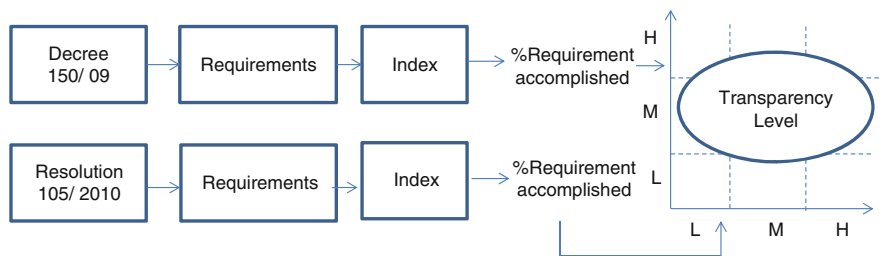


Fig. 1 Methodology to detect the degree of transparency

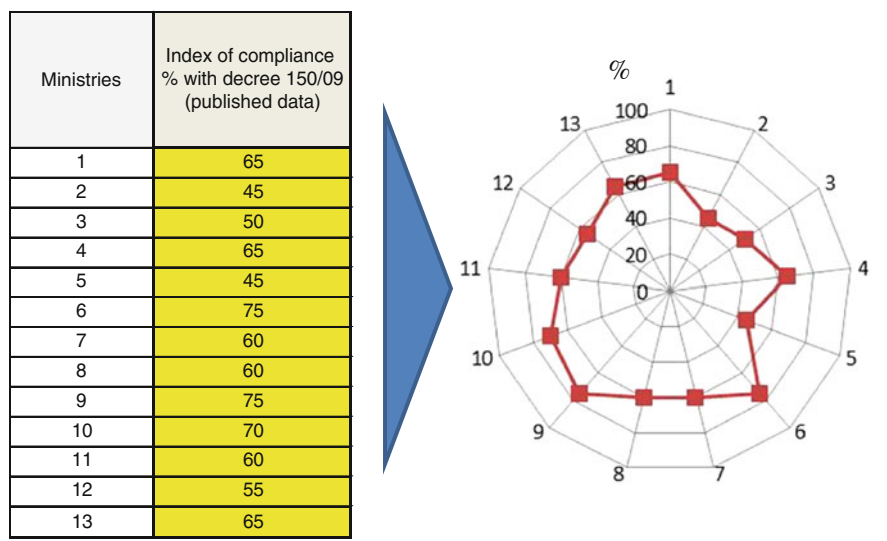


Fig. 2 Compliance with the decree 150/2009

5.1 Subset A Analysis Results: Compliance with the Decree 150/2009

The Fig. 2 clearly shows that ministries are not fully compliant with the decree 150/2009.

The Fig. 3 is a comparison between ministries. Only 2 ministries have published more than 70 % of data required by decree.

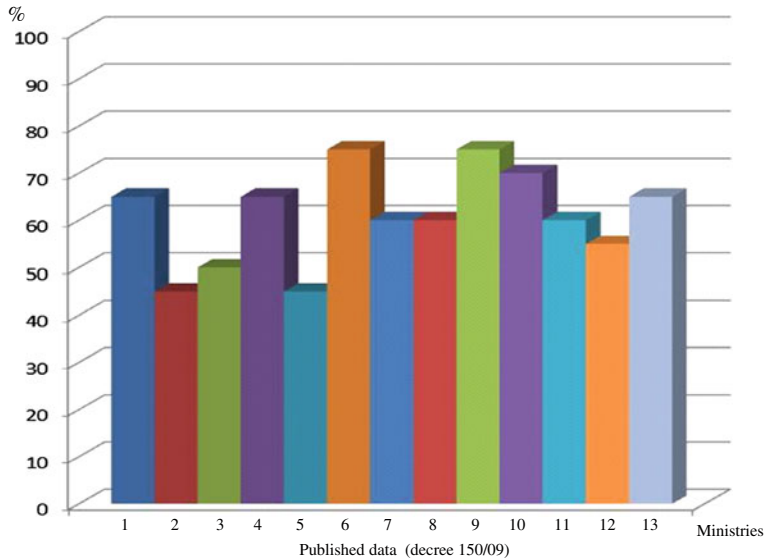


Fig. 3 Comparison between the performance of ministries

5.2 Subset B Analysis Results: Compliance with the Resolution 105/2010

The following Table 5 shows the best (>80 %) and the worst (<20 %) percentage of accomplishment for each item required by decree (highlighted in blue) and by resolution (highlighted in brown). The percentage 100 % means that the whole survey sample (thirteen ministries) has respected the requirement.

0 % means no ministry has met the requirement.

Based on results most of Ministries have published on their websites only the data required by decree. Only 8–15 % ministries have published the data required by resolution 105/2010.

Figure 4 shows a comparison between ministries of the accomplishment percentage of the requirement “data to be published” according to the decree (Table 1) and to the resolution CiVIT (Table 4).

Figure 4 shows that the inclusion of the requirements stated by CiVIT in the subset A) has lowered the percentage of accomplishment for the whole survey sample.

Figure 5 shows the percentage of accomplishment of the requirements stated by CiVIT related to the usability and interactivity. Only the requirement regarding the publication of data in an open format is almost fully compliant with the resolution (almost all ministries have published data in an open format).

The accomplishment percentage of the other requirements is very low, except for 2–4 ministries.

Table 5 The best and the worst percentage of accomplishment

Requirement	%
Area dedicated to Transparency for each corporate websites of PA easily accessible	100
Informative on organizational data (organization chart, offices, nominative of chief manager offices)	100
Email list of the top management and of the chief manger offices (certified email must be highlighted)	100
Curricula, wages and rewards of the persons who hold political-administration position	100
Absence rates and greater presence of personnel	100
Three-year program for the transparency and integrity and its Implementation	92
Performance Plan	92
Curricula of the holders of organizational positions must be written according to the EU format	92
Curricula and wages of the members of the independent evaluation unit (O.I.V.)	92
Codes of conduct	92
Data on “best practices” about proceedings timing and public services delivery	15
Financial and economic data regarding consortia, organizations and companies	15
Web access to the register of beneficiaries of economic providence	15
Total amount of bonuses allocated to the performance and the amount of premiums actually distributed	8
Analysis of data on the degree of differentiation in the use of reward, both for managers and employees	8
Data on economic and financial management of public services: a) services provided to end users and intermediate users	8
Previous programs for the transparency and integrity (including a related status of implementation)	8
Summary overview of the program of transparency	8
Previous status of implementation of the three-year program for the transparency and integrity	8
Quality chart (to allow the monitoring of services delivered by PA)	8
Indicator of the average time of payment for the purchase of goods, services and supplies	0

In order to detect the index of compliance with the resolution, the authors have calculated the average percentages of the requirements achieved (see Table 6).

The result is that the level of transparency is generally low (see Fig. 6). Only ministries 9 and 11 have reached a high level of transparency.

6 Conclusions and Further Research

According to the results, most of the requirements requested by CiVIT are not satisfied. The compliance with mandatory requirements for ensuring transparency is higher when the requirements are stated by decree 150/09 (see Fig. 4 and Table 5).

The “content website analysis”, that is linked to the percentage of publication of the data required by law, indicates that PA achieved an average performance on transparency.

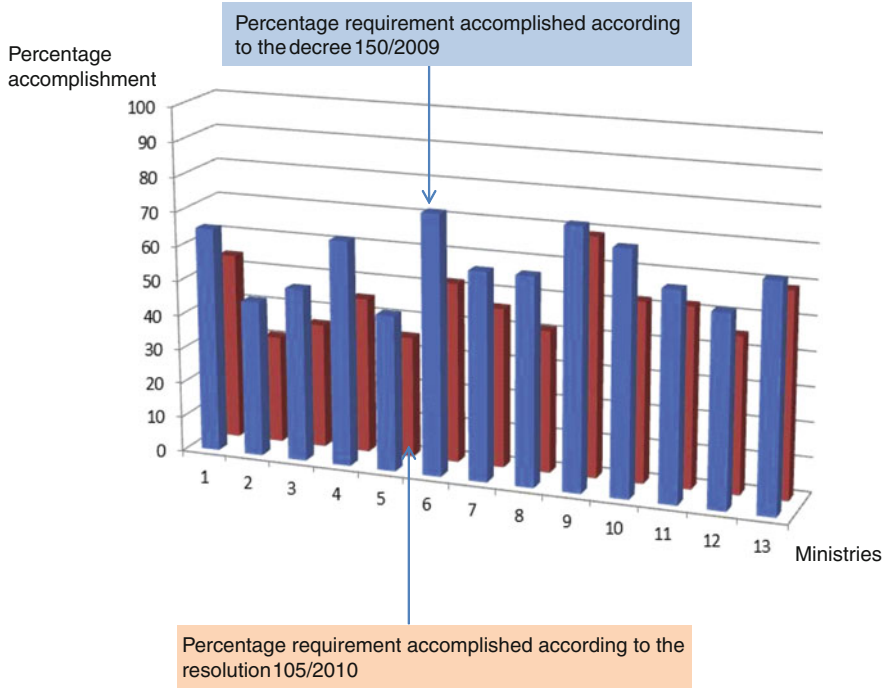


Fig. 4 Comparison of performance about “published data” between ministries

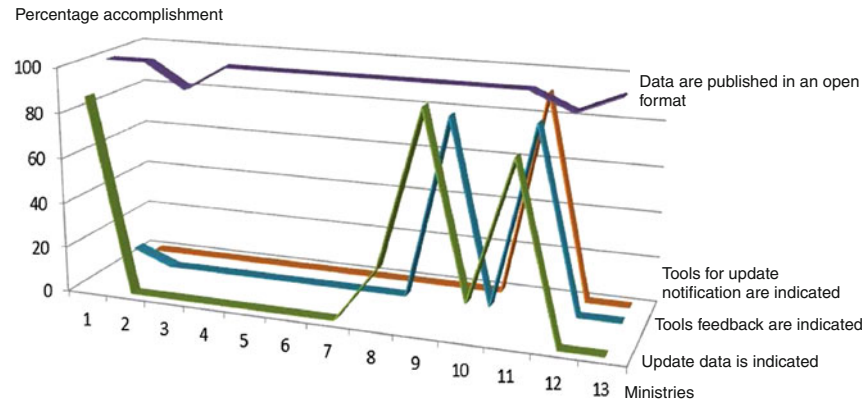


Fig. 5 Percentage of accomplishment of requirements stated by CiVIT

On the basis of results it is possible to state that the general level of transparency is low: only ministries 9 and 11 have achieved a high performance level on transparency.

Table 6 Average percentages of the requirements achieved according to the resolution 105/2010

Ministries	Index of compliance % with resolution 105/2010 (average percentages)
1	50
2	26
3	25
4	29
5	27
6	30
7	29
8	33
9	69
10	33
11	80
12	27
13	32

The reasons of the low level of transparency may be different: analyzing the survey results the authors believe one reason may be that PA focused their attention to accomplish the requirements stated by decree which if not respected would have caused a punishment for the PA (strong legal constraints); for example as the publication on website of the three-year Program for the transparency and integrity and as the performance Plan: PA can't pay the premium performance to the managers if these documents are not published on their website (decree 150/2009, art. 11, paragraph 9).

Some of the requirements with a high accomplishment percentage have in common a low difficulty of achievement (for example such as the publication on the website of curricula of managers, email list of managers, organizational data of the PA, publication of data in an open format). The difficulty of realization of the requirements may be another factor affecting the level of transparency.

The detection of other factors influencing the level of transparency may be the research question of a next article, in order to understand how to improve transparency of information to allow citizen to monitor PA performance through a cost/impacts analysis.

In particular, for the authors, according to the literature [45] that considers the accounting system an element of precondition to achieve the transparency, it would be interesting to extend this research to a wider sample (through a direct interview) in order to understand if the development level of AIS may be a factor that can affect the transparency level. The AIS may assume a strategic role as a tool to gather, process and provide information necessary to improve PA performance in transparency. The research question would be if a well-developed AIS (which maximizes the capacity of elaborating simple data for realizing informative objects), may increase participation and awareness of the citizens about the management of public resources.

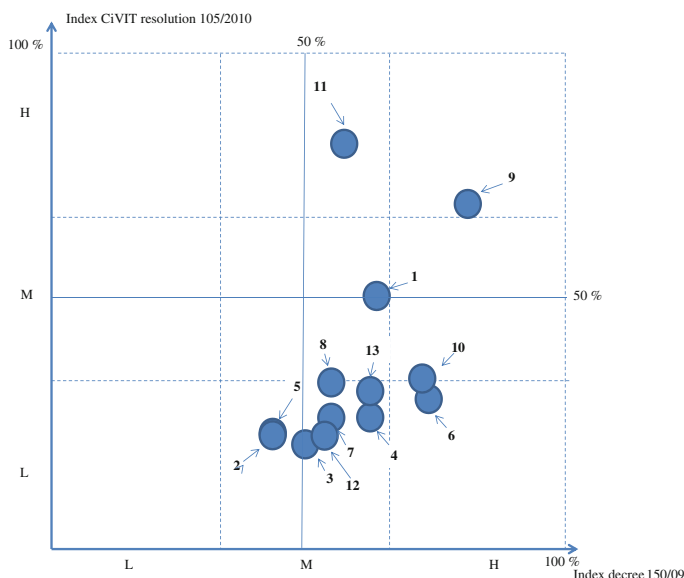


Fig. 6 Level of transparency

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The Current Environmental Strategy Reporting Model: What can be Learned from Corporate Reports?

Stefano Garzella and Raffaele Fiorentino

Abstract This paper explores the information on environmental strategy. Our interest is to understand whether corporate reports are useful to assess a firm's environmental performance. We developed an empirical investigation of annual reports and social reports of large public firms. Using content analysis, our findings show major differences among companies in sensitive, manufacturing/service and financial sectors in terms of: integration of environmental issues into corporate reporting model; disclosure of environmental information. We offer some relevant insights on the overlooked relation between environmental disclosure and environmental performance and on the predominant use of environmental qualitative and/or non financial measures. The study shows that there is: a lack of consideration paid to the relationship between environmental strategies and environmental performance; high variability and limited standardization in environmental practices. Consequently the comparability of environmental performance is very low. Furthermore, integrating theoretical and empirical findings, we suggest some implications to improve environmental disclosure practices.

Keywords Environmental strategy • Environmental disclosure • Reporting model • Content analysis

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1 Introduction

Environmental sustainability and corporate social responsibility are increasingly relevant issues in the current economic context. Recent studies argue that even in industries other than those with high environmental risk, ‘green management’ can play a key role in optimizing manufacturing and new product development processes [1]. Firms may integrate environmental issues in strategic management [2, 3].

A growing number of firms have chosen to invest in green management and environmental performance is an important measure of corporate strategies [4]. At the same time, the literature shows rising interest in whether and how firms align both their strategies to ‘green management’ [5] and the environmental performance to their strategy [6]. In order to advance global practices in the measurement and reporting of environmental performance, standards are developed from supranational organizations, such as the Global Reporting Initiatives (GRI), and international associations, such as Greenpeace. They can also be required by supranational institutions, such as E.U., or national laws. However, concerns on the reliability of environmental disclosures remain valid [7] even though scholars found a positive relation between environmental disclosure and environmental responsiveness [8].

Although the decisions on environmental issues have become more and more important, the relationship between firms’ policies in relation to their environmental strategy and environmental disclosure has been the object of limited research [9]. Previous studies analysed the relation between environmental performance and the level of disclosure [10, 11] as well as between the volume and the quality of environmental disclosure [12]. However, there is a lack of integration across research streams pertaining the study of volume, quality and information potential for external stakeholders of environmental issues in disclosure practices.

This paper has two main objectives. The first is to identify the nature (types) of information contained in corporate reports. The second is to understand what are the relations between the policies related to the disclosure of environmental strategy and external stakeholder’s needs.

In an attempt to answer these questions, we developed a research project composed by three main steps. First, we reviewed the literature on environmental strategies, environmental reporting and the relations between environmental disclosure and environmental strategies. Second, we used content analysis to study environmental strategy information in the disclosure of a sample of Italian firms listed on FTSE MIB index. Third, we suggested potential implications by integrating theoretical and empirical evidence.

The remainder of this paper is divided into five sections. The next section analyses the key existing studies on environmental strategies and environmental disclosure. The following section defines the meaning of the terms ‘environmental strategies’ and ‘green management’ as used in the present study and advance a framework of the strategic management of environmental issues. The third section then explains the methodology that is based on a content analysis of annual social

reports of a sample of public Italian firms. The fourth section shows and discusses the results of the empirical analysis. The final section provides a summary of the findings of the paper and suggests theoretical and practical implications.

2 Environmental Strategy and Reporting Practices: Theoretical and Empirical Contributions

The stakeholder and the corporate social responsibility approach recognize the relevance of the environmental dimension related to the impact and the protection of the biophysical environment in addition to financial and social dimensions [13]. Environmental issues were studied by scholars from many disciplines such as, for example, strategy, operations and accounting. In this work, we study environmental strategies and environmental performance and we integrate theoretical insights and empirical evidence from several areas of studies. Inter alia, we focus on theoretical and empirical contributions on environmental performance and environmental reporting from the domain of strategic management.

Environmental Strategy and the Green Management. The study of reporting practices needs the definition of research boundaries through the clarification of research topic, environmental strategies and green management. At the level of corporate strategy, firms use sustainability strategies to manage their relationships with stakeholders. Thus, they usually have to develop a dynamic balance between corporate goals and the social community [14, 15]. In sustainability strategies, environmental strategies have growing importance and are becoming increasingly relevant [5].

In broad terms, ‘environmental strategies’ can be defined as ‘the organization-wide recognition of the legitimacy and importance of the biophysical environment in the formulation of organization strategy and the integration of environmental issues into the strategic process’ [16, p. 181]. In this vein, environmental strategies identify the acceptance and rooting of environmental values and principles in the strategic management [2, 17, 18].

Environmental strategies differ along a continuum from a reactive to a proactive green management approach and are aligned with several studies in this area. Some scholars argue that there is a trade-off between biophysical environment protection and firm performance because green strategies options imply costs higher than benefits [19]. For these scholars green management first means the reduction of rising costs related to environmental law. However, other studies argue that there is no trade-off between environmental and financial performance [20]. As a consequence, firms need a proactive approach to environmental issues and green management practices [21, 22].

On the other hand, due to the rising attention paid to environmental issues, the term ‘green management’ has recently taken a wider meaning so to embrace very different decisions and actions [23] such as, for example, energy conservation, recycling resources, or the development of new environmentally friendly products. Scholars and firms need a comprehensive framework of green management.

The Environmental Reporting. Environmental measurement systems provide some relevant value drivers and key performance indicators that may be integrated in corporate reports for internal and external communication aims. Among these aims, environmental reporting initiatives are themselves a part of environmental strategies. As Montabon et al. [24], the disclosure of environmental performance is however, subjected to some relevant issues: the quantification of environmental elements that are generally complex; the comparison between different environmental impacts of companies operating in a variety of sectors; the absence of standardized approaches to environmental disclosure despite of the guidelines proposed by different organizations; the availability and quality of environmental information that is relatively low. Scholars found that the main reasons of different volume and quality of environmental disclosures are country factors [25, 26], the industry [27], the size of the firm [28] and the ownership structure [29].

From a methodological point of view, two aspects are often discussed in the literature: the choice of the unit of analysis and the selection of which documents to analyse. In relation to the choice of the unit of analysis, the debate tries to identify the most effective ways of measuring the intent of the communication based on volumetric data. Prior research used as the unit of analysis: phrases or sentences [30], single words [31, 32], pages [11, 33], instances [34]. Several reasons make one alternative better than the others [35]. In respect to which documents to analyse, the main choice is between mandatory and voluntary disclosure. Some studies analysed annual reports [11, 36, 38–40] whilst others focused on voluntary reports [41, 42] such as on the websites [43, 45]. Specifically, individual investors seem to prefer annual report information on environmental activities than information about any other social activity [46]. Empirical investigation on both mandatory and social reports is limited.

The Global and Italian Practices in Environmental Disclosure. Environmental performance measurement and disclosure is increasingly becoming a global phenomenon because the recognition that many environmental issues have a supra-national relevance. Moreover, the globalization of stock markets requires standard and comparability while industrial, international and governmental organizations are pushing for the development of environmental management systems, environmental disclosure and environmental metrics [47, 48]. These organizations (e.g. E.U., Global Compact, ISO, GRI) provide standards for environmental policy, operations, disclosure and performance. In addition, some previous contributions encourage standardization in environmental performance measurement [49, 50].

The comparison of several studies on environmental disclosure practices in different countries usually shows a vague, incomplete and unreliable disclosure across several Countries such as the U.S. [40, 51], the Europe [52, 53], and the Australia [54, 55].

In the same vein, other research investigated environmental performance practices in several countries such as the U.S. [56] and the Europe [57]. These studies are mainly based on case studies and on the identification of best practices and, consequently, do not generally favor the comparability across corporate practices. Vice versa, since information reported by companies is quite different in

terms of content, boundaries, styles and measures, it is generally difficult for external stakeholders to judge a firm's environmental performance [58].

Despite of these globalization spurs, some common results in disclosure and measurement practices from research in different countries, and the production of a series of standards and benchmarks that firms can use as guidelines, there is no evidence of an effective standardization in environmental performance measurement and disclosure [59].

In addition, following innovations on environment disclosure introduced by a regulation in 2007 (D.Lgs 32/2007), Italian companies were required to provide environmental information for the first time in their 2008 annual report. In particular, in order to fulfill the disclosure requirements of the law, companies were required to report information on the environmental damage for what the company was found guilty or the sanctions or penalties they received related to environmental crimes and damages, such as for gas emissions. They may also decide (yet it is required for larger companies) to disclose environmental investments and environmental costs, policies for waste reduction, environmental certifications, gas emissions (D.Lgs. 316/2004) and any green certification (if the company does not fall within an area for which this information is mandatory). Following the intervention of the regulator, some professional organizations (e.g. CNDCEC, the Italian Certified Accountants Association) prepared a document with information on how firms may report environmental disclosure in the annual report [60] and then led an explorative investigation on the real implementation of this prescription on a sample of public Italian firms [61]. In this sense, the effects produced by regulatory activity on the mandatory environmental reporting and environmental performance practices remain to be systematically investigated.

The environmental performance measurement and disclosure practices of Italian firm can indeed vary with reference to company decisions such as the adoption of global standards suggested from supranational organizations such as GRI or national standard, proposed by national organizations such as GBS (Social report study group), the utilization of environmental performance indicators suggested by professional organizations as CNDCEC, the compliance to obligations imposed by the country regulation as in the law 32/2007; the instructions from supranational institutions such as UE directives.

3 Environmental Issues into the Strategy Process: the Relevant Items of an Environmental Strategy Reporting Model

Prior research as well as business practice in many areas (e.g. strategic management, accounting, etc.) has developed several categorizations, frameworks and models on green management. The GRI, an organization dedicated to sustainability strategies reporting, identifies in its 2008 guidelines three relevant categories: strategy and corporate profile, management approach and performance

indicators [62]. In line with this classification, Montabon et al. [24] in a recent survey on environmental disclosure identify four categories of elements: operational, tactical, strategic and performance. Sroufe et al. [63] argue that the practices relating to environmental strategies generally have a outward-looking focus and are made up of a set of goals, plans and policies established by the top management to reflect the company's attitude towards the environment. In the same vein, further studies on managerial practices identified specific elements of environmental strategies [6, 13, 64, 65]. However, they are still inconsistent due to a lack of an unifying framework able to integrate so many elements and to outline the content with reference to both the 'formulation' and 'implementation' step of the strategic process [66].

Thus, in an attempt to bridge the gap in the literature, to facilitate the comparability of research results, to correlate theoretical [4] and operational [62] proposals, and to analyse environmental strategies in a systematic way, we have developed a framework that allows to capture the variety of elements of green management in different stages of the strategic process.

The framework has been developed in line with the framework on the sustainability of Epstein and Roy [4], based on an action-strategy-performance approach [67, 68]. This framework has been integrated taking into account the major contributions on the subject and the evidence emerging from a first analysis on the Italian companies listed on the FTSE MIB. Through an examination of annual reports, reports and sections of corporate websites dedicated to the environment and sustainability we 'mapped' the potential items of environmental strategies and then we arranged them in specific categories.

In the framework, environmental strategies are showed into three categories: the category of 'formulation', with reference to the integration of the legitimacy and importance of the biophysical environment into the formulation step of strategic process; 'implementation', related to environmental actions at the time of the implementation process; and finally 'performance' with reference to the results obtained and the actual impact of strategic actions on the biophysical environment.

Each category has been structured so as to cover, in a comprehensive view, every item of environmental strategies and to allow the subsequent effective analysis of environmental performance. The overall framework in its full articulation in categories and items is shown in Fig. 1. If firms recognize the legitimacy and importance of the biophysical environment, green management will affects corporate and business unit strategies. For instance, it will shape social strategies because environmental issues would be integrated in firms' mission and vision; portfolio strategies when firms decide to entry in green business, to give up pollutant business or sign strategic alliances for green goals; organizational strategies, if green organizational units—firms, business units, committee, etc.—are developed in the organizational structure; financial strategies, when green investments are chosen instead of alternative investments; differentiation or cost leadership strategies to get competitive advantage.

Environmental performance can be related to the outcomes of firms' actions on the biophysical environment and to the protection of environmental resources [58].

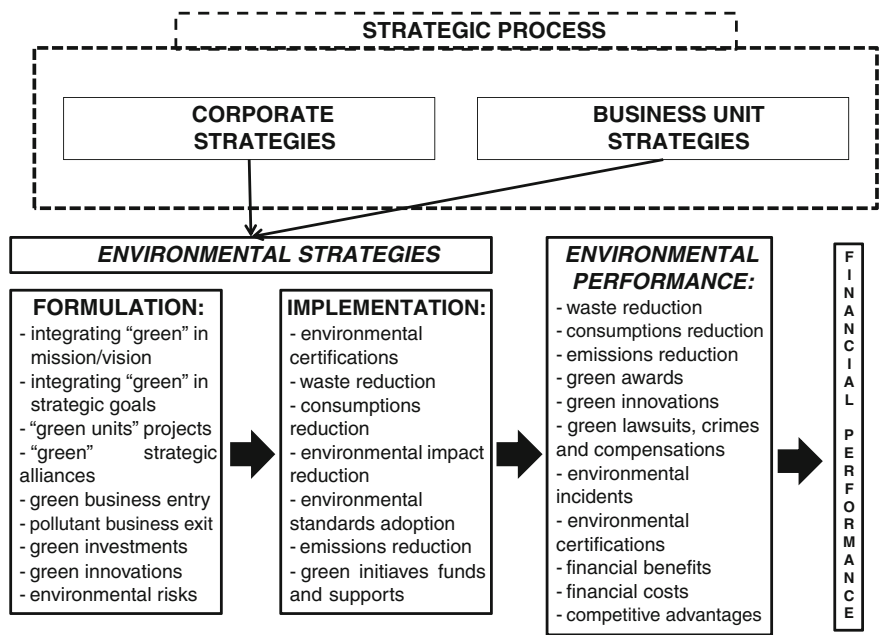


Fig. 1 A framework on environmental issues into the strategic process

Moreover, in a win-win approach, costs and benefits directly associated to environmental strategies must also be evaluated [69].

With this framework we focus on quantifying the link between environmental strategies and environmental performance, a link that is generally underestimated by firms [4].

Overall, the success of environmental strategies is the result of both the process of formulation and decision-making and the subsequent implementation [66, 68]. However, studies show that managers find often difficult to transform strategy into action [4]. Many companies do not pay adequate attention to the relations between environmental strategies, strategy implementation and the achieved results [70]. Consequently, the analysis of environmental strategies and performance in the firms' disclosure should investigate the strategic ideas, goals and actions required to implement these ideas as well as the consequences of those actions on environmental performance of companies. Previous studies, however, generally make a partial analysis of environmental strategies and performance, focusing sometimes only on strategic issues, other times only on operative issues and some other times on performance [71, 72]. At the same time, few studies of corporate environmental reporting analysed environmental responsiveness in a comprehensive view [8].

In this domain, disclosure analysis appears as a useful way to investigate corporate practices. Although the importance of environmental reporting practices has been recognized by scholars, much remains to be explained.

4 A Content Analysis of Environmental Strategy Reporting Model

Consistent to interpretive studies [73], the empirical investigation is based on a content analysis. Scholars found that there is a positive relation between the volume of environmental disclosure and the attention paid to environmental problems [38, 74], the environmental disclosure communicates fairly to stakeholders what the main challenges for environmental management are [32], the communication strategy used by firms signals the importance placed by management on a specific topic [74], environmental disclosure is the preferred way to report environmental performance [75]. Accordingly, we found that a content analysis of corporate reports was an useful method to analyse environmental strategy reporting model. Despite some criticism of details in the application of this method [74, 76], prior empirical studies tended to use content analysis as their preferential data collection method for environmental issues [12, 30, 77, 78]. This section explains the methodological choices made in undertaking the content analysis for this study and in answering each research question.

Defining environmental strategies and performance items. The use of content analysis needs a clear explanation of categories and items of environmental strategies and performance since, without this, it is difficult for others to understand and compare the results of the study [36].

In this study environmental strategies are defined and then analysed in terms of a number of narrow elements within three broad categories. This choice is consistent with several prior studies [11]. In defining categories and elements, we used the definitions and boundary criteria, described in the prior framework on green management. Despite of alternative choices such as GRI categories and items, the use of our framework allows an in-depth analysis of the overall environmental strategy and more effectively reflects the various steps of the strategy process. Criteria and definitions were adapted to the Italian context by an adaptation process that involved the two authors of this paper, working as coders independently of one another. Each author analysed categories and items definitions of three firms, belonging to three different sector groups, in a three stage process that ensured that the definitions of the content analysis categories and elements were reliable [30,79].

Scope of the Reports Analysed. For this study, the type of corporate reports to be analyse was determined in relation to the research questions. So, in order to find which companies recognized the legitimacy and importance of the biophysical environment in the formulation of their organization strategy and the integration of environmental issues into the strategy process, we analysed the group annual reports. This choice was made in order to: analyse a wide range of data, with reference to both subsidiaries and strategic issues and increase comparability, using mandatory reports available for all firms.

The decision to report environmental results in social reports or in annual reports and the aim of having a comprehensive view of environmental performance led us to analyse voluntary reports. So, in order to understand how firms

measure environmental performance and what are the drivers and the key performance indicators relevant to measure the firm's environmental performance we enlarged the analysis to include voluntary reports about sustainability and green management. This choice was made in order to analyse as many practices as possible [78]. However, in any study it is necessary to limit the range of documents analysed to prevent the number of documents for any single organization in the sample becoming overwhelming. The boundaries were set in this study with reference to: sustainability report, sustainability plan, environmental report and environmental policies. If a particular disclosure was made in more than one type of corporate report it was recorded once for every time and for every corporate report in which it was disclosed [74].

Data collection was made on electronic documents from the Italian stock exchange website (www.borsaitaliana.it) and/or the website of each firm. All documents were.pdf files. We have analysed the 2009 corporate reports, the most recent at the time of the research but also the first where we could find the adoption of both 'D.Lgs 32/2007' requirements and the third generation of GRI standards.

The Sample. Having defined the scope of the reports to be analysed, we selected the sample. The sample comprises the Italian firms listed on the FTSE MIB index (Table 1). The sample choice of Italian firms was induced by both the absence of prior empirical analysis and the new mandatory environmental disclosure in annual reports. Among Italian firms the analysis was confined to listed firms subjected to disclosure requirements so to ensure data availability. Finally, since previous studies found a relation between environmental reporting and firm size [41, 43, 80, 81], the sample was limited to FTSE MIB index firms.

The FTSE MIB is the primary benchmark Index for the Italian equity markets. Capturing approximately 80 % of the capitalization of the domestic market, the Index is comprised of highly liquid, leading companies across ICB sectors in Italy. The final sample comprises 38 companies across several industries. The sample number is consistent with similar studies [24, 81].

Unlike prior research the firms in the sample were categorized by business types according to environmental issues. We thus developed three groups: sensitive, with 7 firms in green businesses and/or environmentally sensitive businesses; manufacturing/services, with 19 firms competing without any special involvement in green businesses; financial, with 12 firms in financial services, insurance and bank sector. This categorization is consistent with the need to respond, in environmental strategies and performance, to the evidences of previous studies: for green and sensitive companies environmental performance was different from other firms; different practices between industrial and financial companies [26, 39].

In the definition of firm types we followed criteria from prior studies, properly adapted to the categorizations of the Italian stock exchange sector [41, 82–84]. The definition process was articulated in two steps: first, we distinguished financial firms (insurance, banks and financial services); second, among the remaining firms we detached sensitive firms (chemical, basic resources, oil and gas and utilities) from manufacturing/services firms (construction and materials, industrial good and services, automotive and parts, food and beverage, personal and household goods,

Table 1 The features of sample firms

Name	Industry	Type	Social reports
A2A	Utilities	Sensitive	Yes
Ansaldo	Industrial goods and services	Manufacturing/service	No
Atlantia	Industrial goods and services	Manufacturing/service	Yes
Augogrill	Travel and leisure	Manufacturing/service	Yes
Azimut	Financial services	Financial	No
Banca MPS	Banks	Financial	Yes
Banca Pop. Milano	Banks	Financial	Yes
Banco popolare	Banks	Financial	Yes
Bulgari	Personal and household goods	Manufacturing/service	No
Buzzi Unicem	Construction and materials	Manufacturing/service	Yes
Campari	Food and beverage	Manufacturing/service	No
Diasorin	Health care	Manufacturing/service	No
Enel	Utilities	Sensitive	Yes
Eni	Oil and gas	Sensitive	Yes
Exor	Financial services	Financial	No
Fiat	Industrial goods and services	Manufacturing/service	Yes
Finmeccanica	Industrial goods and services	Manufacturing/service	Yes
Fondiaria	Insurance	Financial	Yes
Generali Assic	Insurance	Financial	Yes
Impregilo	Construction and materials	Manufacturing/service	Yes
Intesa San Paolo	Banks	Financial	Yes
Lottomatica	Travel and leisure	Manufacturing/service	Yes
Luxottica	Personal and household goods	Manufacturing/service	Yes
Mediaset	Media	Manufacturing/service	No
Mediobanca	Banks	Financial	No
Mediolanum	Insurance	Financial	Yes
Parmalat	Food and beverage	Manufacturing/service	No
Pirelli and C	Automotive and parts	Manufacturing/service	Yes
Prysmian	Industrial goods and services	Manufacturing/service	Yes
Saipem	Oil and gas	Sensitive	Yes
Snam rete gas	Utilities	Sensitive	Yes
Stmicreletttonics	Technology	Manufacturing/service	Yes
Telecom Italia	Telecommunications	Manufacturing/service	Yes
Tenaris	Basic resources	Sensitive	Yes
Terna	Utilities	Sensitive	Yes
Tod's	Personal and household goods	Manufacturing/service	No
Ubi	Banks	Financial	Yes
Unicredit	Banks	Financial	Yes

health care, trade, travel and leisure, telecommunications, real estate and technology). We also showed the presence or absence of social reports for the firms in the sample.

Identifying and Quantifying the Disclosure of Environmental Strategies. One of the main assumptions underlying quantitative content analysis is that the volume and frequency of disclosure of a particular item signal how important the writer of

the report considers that item to be [11, 30, 31]. Most content analysis studies of corporate reports have measured this volume of disclosure either in terms of the amount of space devoted to each relevant disclosure (either in terms of the words, sentences, paragraph or proportions of pages), or have simply counted the instances of disclosure. The last practice was adopted in this study.

Before counting the disclosure of environmental strategies and performance, we read each report in order to identify and code every instance of disclosure that corresponded with the items of the proposed framework. This process involved the two authors working as coders independently of one another. First, one of the authors read all the corporate reports, marking and coding each disclosure related to an item of environmental strategies and performance. Second, another author, independently of the former, coded the reports.

The two sets of codes of the reports were then compared and discussed by all the authors. Based on updated coding rules we did a new analysis on three firms, one for each type, and comparing the results we had a consistency rate of 90 %, appropriate to proceed to the next steps. These coding rules were adopted for the subsequent analysis.

Overall, through the identification, coding and quantification of each item, data about environmental strategies and performance were recorded in an electronic database. This database contained one worksheet for each firm's corporate report, with the record of: the name of the firm, the firm's sector group, the disclosure categories, the environmental strategies and performance items, the level of quantification of environmental performance disclosure (monetary quantification, non-monetary quantification, narrative), the size of disclosure (number of instances), any descriptive notes. In the analysis of the sample firms, 6.180 instances (1.147 in annual reports and 5.033 in social reports) were identified, coded and reported.

5 Findings

This section provides and discusses the results of environmental strategies and performance analysis. Results are reported with reference to each aim. The section starts with the analysis of the practices in the reporting of environmental strategy and environmental performance. Following this results, we relate environmental strategies to environmental performance.

The Reporting of Environmental Strategy. Table 2 shows the mean number of environmental strategies disclosures in the sample firms analysed by category and item.

Disclosures about the two categories of environmental strategies are quite similar. The analysis of single items provides interesting findings. Actions of environmental impact reduction actions, including unclear initiatives for generic environmental actions, show the highest level of disclosure (3.184). This practice could signify two things. On the one hand, the firm's aim is to get the public image of an eco-friendly company paying great attention to green issues, irrespective of

Table 2 Analysis of mean number of disclosures by sector group and environmental strategies categories and items

Categories and items of disclosure	Mean number of disclosures per company per sector group			
	Sensitive	Manufacturing/service	Financial	Average
Integrating “green” in mission/vision	4.857	1.684	1.417	2.184
Integrating “green” in strategic goals	4.571	2.053	1.250	2.263
“Green units” projects	8.143	2.368	0.417	2.816
“Green” strategic alliances	4.000	0.947	0.250	1.289
Green business entry	2.000	0.316	0.417	0.658
Pollutant business exit	0.857	0.000	0.000	0.158
“Green” investments	1.143	0.263	0.667	0.553
“Green innovations”	2.000	0.842	0.333	0.895
Environmental risks	2.429	1.000	0.500	1.105
<i>Total formulation</i>	30.000	9.474	5.250	11.921
<i>Total formulation AS %</i>	52.5 %	52.3 %	65.0 %	53.7 %
Environmental certifications	0.571	0.579	0.333	0.500
Waste reduction actions	4.286	0.842	0.167	1.263
Consumptions reduction	6.143	1.895	0.750	2.342
Environmental impact reduction	7.429	3.105	0.833	3.184
Environmental standards adoption	1.571	0.684	0.333	0.737
Emissions reduction	7.000	1.474	0.083	2.105
Green initiatives funds and supports	0.143	0.053	0.333	0.158
<i>Total implementation</i>	27.429	8.632	2.833	10.263
<i>Total implementation AS %</i>	47.5 %	47.7 %	35.0 %	46.3 %
<i>Total items</i>	57.143	18.106	8.083	22.328

any real or effective green management initiative. On the other hand, it could show the inability to translate a real green management involvement into effective and specific actions [69], or to report these actions.

Vice versa, green units projects, including ideas and goals related to the creation of specific organizational units for green issues (such as an environmental strategies committee or an environmental issues audit board), show the second highest level of disclosure, evidence of the real legitimacy and importance of the biophysical environment into the strategic process of Italian firms.

The lowest disclosures of environmental strategies concern items such as: ‘pollutant business exit’, including exit decisions from businesses related to high environmental issues, symbolizing the difficulties about some business disposals; ‘green initiatives funds and support’, including actions aimed at funding action for environmental protection, an indication of a lack of awareness about this topic. The disclosure about ‘environmental standards adoption’, including initiatives for the adoption of standards such as GRI, Global compact, GBS or ISO 26000, shows a relatively low level, far from the desirable advancing of global practices (0.737).

The median and standard deviation analysis (Table 3) highlights levels of variability of each item that are, generally, very high. This means that the mean number of disclosures for each item is the result of the high level of disclosures for

Table 3 The disclosure of environmental strategies and performance within the sample

Firm	Annual reports			Social reports		
	Environmental strategies		Environmental performance items	Total items	Number of reports	Environmental performance items
	Formulation items	Implementation items				
A2A	76	97	19	192	3	352
Ansaldo	16	17	3	36	0	0
Atlantia	9	32	23	64	1	100
Autogrill	5	4	3	12	1	103
Azimut	0	0	0	0	0	0
Banca MPS	12	8	5	25	2	120
Banca pop. Milano	2	2	0	4	1	29
Banco popolare	5	0	0	5	1	61
Bulgari	1	0	0	1	0	0
Buzzi Unicem	4	5	19	28	1	108
Campari	2	0	0	2	0	0
Diasorin	0	0	0	0	0	0
Enel	33	14	15	62	3	2,378
Eni	23	39	21	83	1	94
Exor	4	0	0	4	0	0
Fiat	24	25	29	78	2	174
Finmeccanica	23	20	10	53	1	77
Fondiaria	7	2	2	11	1	74
Generali	9	3	1	13	1	0
Impregilo	25	12	5	42	1	78
Intesa San Paolo	11	8	13	32	2	159
Lottomatica	17	17	8	42	1	30
Luxottica	1	0	1	2	1	0
Mediaset	4	0	1	5	0	0
Mediobanca	0	0	0	0	0	0
Mediolanum	0	0	0	0	1	14
Parmalat	1	2	0	3	0	0
Pirelli e c	20	1	3	24	1	84
Prysmian	9	7	20	36	1	133
Saipem	20	12	8	40	2	69
Snam rete gas	23	13	20	56	1	159
Stmicroelectronics	12	8	1	21	1	101
Telecom	7	14	39	60	2	211
Tenaris	1	0	3	4	1	37
Terna	34	17	24	75	1	160
Tod's	0	0	0	0	0	0
Ubi	13	8	6	27	2	58
Unicredit	0	3	2	5	2	70
<i>Total</i>	453	390	304	1,147	39	5,033

certain firms and the nearly totally absence for others. Indeed, the analysis per sector groups exhibits significant differences in environmental strategies disclosures of sensitive, manufacturing/services and financial groups.

Specifically, consistent with expectations [41], firms of sensitive groups, showing the highest level of disclosure (57.143), seem to recognize, more than the

others, the legitimacy and importance of the biophysical environment in the formulation of organization strategy and the integration of environmental issues into the strategic process.

Findings are also consistent with the expectation of significant differences in environmental practices between industrial (18.106) and financial (8.083) firms [26, 39]. Indeed, with reference to single items analysis the financial group significantly differs from the sensitive and manufacturing/services group: the items 'integrating green in mission/vision' (1.417), including the presence of environmental issues in the mission and/or vision of the firm, and 'integrating green in strategic goals' (1.250), including the reference to green management in the definition of future strategic aims, have the highest level of disclosure. There are some important differences in environmental practices between the sensitive and manufacturing/service group such as the relatively greater importance in manufacturing/service group of certification initiatives and the relatively lower importance of actions for emissions reduction.

The Reporting of Environmental Performance. Table 4 shows the mean number of annual report disclosures of environmental performance by sector groups, analysed by items.

The analysis of single items reports the lowest level of disclosure for: 'competitive advantages' (0.105), including disclosure of the impact of environmental strategies on sources of competitive advantages, probably evidence of difficulties in interpretation and measurement of environmental strategies on competitive results; 'financial costs' (0.132), including negative direct effects on financial results of green management, and 'environmental incidents' (0.143), including all incidents related to environmental issues, both expected findings based on the possible impact of this disclosure on firms environmental image and reputation.

The result of 'green lawsuits, crimes and compensations' (0.500), relatively low, is also interesting given the requirement by regulation (D.Lgs 32/2007) of this information. Vice versa, 'green awards' (2.000) reach the highest level of disclosure perhaps because, probably for summary reasons, awards are a simple measure of environmental performance and a mean of legitimizing. The item 'green awards' is the highest in each sector group.

However, among sector groups there are relevant differences both in volume and contents of environmental performance disclosure. Sensitive firms show a mean number of disclosure higher than manufacturing/service and financial firms but for items such as 'waste reduction', including results about waste reduction and recycling, and 'consumptions reduction', including results about energy, gas, water, and others materials, the disclosure for manufacturing/service firms is higher than for sensitive firms. Relatively, these companies pay much greater attention to different items such as 'financial benefits', 'green lawsuits, crimes and compensations' and 'environmental certifications'.

The median and standard deviation analysis (Table 5) highlights levels of variability of each item, generally, very high. Specifically the median analysis shows that most of the manufacturing/service and financial firms do not report any disclosure about environmental performance. Accordingly, standard deviation analysis

Table 4 Analysis of mean number of disclosure by sector group and environmental performance items

Items of disclosure	Mean number of disclosures per company per sector group							
	Sensitive		Industrial		Financial		Mean number	
	Annual report	Social reports	Annual report	Social reports	Annual report	Social reports	Annual report	Social reports
Waste reduction	0.571	179.000	0.789	20.583	0.250	11.778	0.579	57.357
Consumptions reduction	1.429	91.143	1.789	34.250	0.333	25.000	1.263	45.500
Emissions reduction	2.296	126.429	1.263	22.417	0.167	16.000	1.105	46.357
Green awards	3.714	11.429	2.158	5.583	0.750	4.000	2.000	6.536
Green innovations	2.000	12.143	1.105	7.750	0.167	1.778	0.974	6.929
Green lawsuits, crimes and compensations	1.714	14.286	0.211	0.833	0.167	0.222	0.474	4.000
Environmental incidents	0.286	3.429	0.053	0.583	0.167	0.000	0.132	1.107
Environmental certifications	1.714	22.714	0.684	5.833	0.333	1.111	0.763	8.536
Financial benefits	1.286	1.857	0.421	1.167	0.083	4.667	0.474	2.464
Financial costs	0.571	0.571	0.053	0.083	0.000	0.111	0.132	0.214
Competitive advantages	0.143	1.143	0.158	0.833	0.000	0.333	0.105	0.750
<i>Total items</i>	15.714	464.143	8.684	99.917	2.417	65.000	8.000	179.750

per sector groups exhibits significant differences in environmental performance disclosures of sensitive, manufacturing/services and financial groups, with an overall disclosure variability lower in relation to manufacturing/service firms.

In order to complete the analysis about how Italian firms measure environmental performance, the content analysis of disclosure was extended to social reports. Italian firms developed specific reports for environmental issues, sometimes provided on their own, and, at other times, included in sustainability reports (Table 3). In our sample, 28 firms provided social reports: all sensitive firms made available 12 documents; 12 of 19 manufacturing/service firms made available 14 documents; 9 of 12 financial firms made available 13 documents. Table 9 shows the mean number of environmental performance disclosures in overall social reports by sector groups, analysed by items.

The analysis of results from voluntary reports highlights overall levels of environmental performance disclosures higher than in annual reports. Specifically, in annual reports sensitive firms show the highest level of disclosures (464.163) whilst financial firms the lowest (65.000). Despite annual reports results, the disclosure of manufacturing/service firms (99.917) is proportionally lower than firms in other sector groups.

The analysis in comparison with annual reports indicates for all sector groups the varying importance of single items, while 'waste reduction' and 'consumption

Table 5 The median and standard deviation of annual reports disclosure of environmental strategies by sector, group, category and item

Categories and items of disclosure	Median of disclosure per firm per sector					
	Sensitive		Manufacturing/service		Financial	
	Median	Standard deviation	Median	Standard deviation	Median	Standard deviation
Integrating “green” in mission/vision	4.000	4.525	1.000	1.887	0.500	1.832
Integrating “green” in strategic goals	6.000	3.259	1.000	2.738	0.000	1.658
“Green units” projects	4.000	11.510	1.000	3.774	0.000	0.793
“Green” strategic alliances	4.000	3.512	0.000	1.957	0.000	0.452
Green business entry	2.000	2.082	0.000	0.671	0.000	1.443
Pollutant business exit	1.000	0.900	0.000	0.000	0.000	0.000
“Green” investments	0.000	1.574	0.000	0.452	0.000	1.073
“Green innovations”	1.000	2.449	0.000	1.167	0.000	0.778
Environmental risks	3.000	2.440	0.000	1.491	0.000	0.674
<i>Total formulation</i>	23.000	23.022	7.000	8.784	4.500	5.029
Environmental certifications	0.000	0.787	0.000	1.261	0.000	0.651
Waste reduction actions	1.000	7.994	0.000	1.344	0.000	0.577
Consumptions reduction	2.000	10.792	0.000	3.348	0.500	0.866
Environmental impact reduction	6.000	5.503	1.000	3.619	0.000	1.193
Environmental standards adoption	1.000	1.512	0.000	1.250	0.000	0.888
Emissions reduction	3.000	12.503	0.000	2.525	0.000	0.289
Green initiatives funds and supports	0.000	0.378	0.000	0.229	0.000	0.778
<i>Total implementation</i>	14.000	32.817	5.000	9.748	2.000	3.326
<i>Total items</i>	21.500	27.266	6.000	9.162	2.500	4.349

reduction' are much more important in all sector groups. In line with our expectations, for sensitive firms 'waste reduction' (179.000) and 'emissions reduction' are the main environmental issues. Instead for manufacturing/service and financial firms 'consumption reduction' is the most relevant item.

The median and standard deviation analysis (Table 6) highlights levels of variability of each item, generally, very high. Specifically, sensitive firms, in contrast with annual reports disclosure, have a higher variability than other firms. So for example for sensitive firms the median of 'emission reduction' is higher than the median of 'waste reduction'. This depends upon the disclosure of a single sample firms that reported early half of the total disclosure of sensitive firms (Table 7).

Based on the significance of the distinction between financial and non financial indicators, on the one hand, and quantitative and qualitative indicators, on the other, we need to deepen the level of quantification of environmental performance in our investigation [85]. In this vein, Table 8 shows the mean number and the proportion of annual report disclosures of environmental performance by items quantified in monetary terms, in non-monetary terms or narrative/discursive disclosures with no quantification.

Table 9, instead, shows the mean number and the proportion of annual report environmental performance disclosures by sector group and level of quantification.

From the analysis of the results, there is a predominance of narrative/discursive disclosure, with a moderate proportion of quantitative non monetary quantification and the nearly totally absence of disclosure in monetary terms. Only three items, 'green lawsuits, crimes and compensations', 'financial benefits' and 'financial costs' received a monetary disclosure and only for waste reduction is there a predominance of quantitative non monetary disclosure.

The overall proportion of narrative disclosures ranges from an average of 77 % in sensitive firms to 68 % in financial firms and 76 % in manufacturing/service firms. While monetary disclosure is negligible in all sector groups (3 % for sensitive and manufacturing firms and 0 % for financial firms), the extent of non monetary quantified disclosures seems to vary from sensitive and manufacturing/service groups (19 and 20 % respectively) to financial firms (31 %).

These finding are consistent with, on the one hand, prior studies on corporate disclosure that generally show a narrative disclosure predominance (Hughes et al. 2001) and, on the other, with the expectations of poor links in firms practices between environmental performance and its financial effects [24].

Instead, based on the analysis of social reports, Table 8 shows the mean number and the proportion of social report environmental performance disclosures by items quantified in monetary terms, in non-monetary terms or narrative/discursive disclosures with no quantification. Table 9 shows the mean number and the proportion of social report environmental performance disclosure by sector group and level of quantification.

Surprisingly, in contrast with the results related to annual reports and prior studies, there is a predominance of quantitative non monetary disclosure, with a moderate proportion of narrative quantification and the nearly totally absence of

Table 6 The median of annual reports disclosure of environmental performance by sector group and item

Categories and items of disclosure	Median of disclosure per firm per sector					
	Sensitive		Manufacturing/ service		Financial	
	Median	Standard deviation	Median	Standard deviation	Median	Standard deviation
Waste reduction	0.000	0.976	0.000	1.475	0.000	0.622
Consumptions reduction	1.000	1.618	1.000	2.485	0.000	0.651
Emissions reduction	1.000	2.309	0.000	2.023	0.000	0.888
Green awards	2.000	5.438	0.000	6.103	0.000	1.765
Green innovations	2.000	1.826	0.000	2.447	0.000	0.577
Green lawsuits, crimes and comp	2.000	1.496	0.000	0.631	0.000	0.389
Environmental incidents	0.000	0.488	0.000	0.229	0.000	0.389
Environmental certifications	2.000	1.890	0.000	1.108	0.000	0.651
Financial benefits	1.000	1.604	0.000	0.902	0.000	0.289
Financial costs	0.000	0.787	0.000	0.229	0.000	0.000
Competitive advantages	0.000	0.378	0.000	0.501	0.000	0.000
<i>Total items</i>	19.000	2.268	3.000	2.367	0.500	0.696

Table 7 The median and standard deviation of social report disclosure of environmental performance by sector group and item
Categories and items of disclosure Median of disclosure per firm per sector

	Sensitive		Manufacturing/service		Financial		Total	
	Median	Standard deviation	Median	Standard deviation	Median	Standard deviation	Median	Standard deviation
Waste reduction	29.000	396.108	20.500	12.852	6.000	14.610	19.000	200.318
Consumptions reduction	35.000	147.267	31.500	24.849	23.000	20.322	28.500	77.005
Emissions reduction	43.000	218.985	18.500	20.079	5.000	17.713	21.500	114.621
Green awards	9.000	10.406	3.000	7.856	5.000	4.330	5.000	7.970
Green innovations	3.000	16.678	6.500	7.545	2.000	1.922	3.000	10.114
Green lawsuits, crimes and comp	1.000	28.889	0.000	1.586	0.000	0.667	0.000	14.942
Environmental incidents	0.000	8.223	0.000	0.900	0.000	0.000	0.000	4.157
Environmental certifications	11.000	31.873	6.000	3.834	0.000	2.028	4.000	17.513
Financial benefits	0.000	4.059	1.000	1.115	1.000	11.045	1.000	6.540
Financial costs	0.000	1.512	0.000	0.289	0.000	0.333	0.000	0.787
Competitive advantages	0.000	1.864	0.000	1.992	0.000	1.000	0.000	1.669
<i>Total items</i>	159.000	850.160	100.500	56.511	61.000	50.192	89.000	436.869

Table 8 Mean number of environmental performance disclosure by items and level of quantification

Items of disclosure	Mean number of disclosures per company per level of quantification							
	Quantitative monetary		Quantitative non monetary		Narrative		Mean number	
	Annual report	Social reports	Annual report	Social reports	Annual report	Social reports	Annual report	Social reports
Waste reduction	0.000	0.107	0.342	52.857	0.237	4.393	0.579	57.357
Consumptions reduction	0.000	0.464	0.579	38.000	0.737	7.036	1.263	45.500
Emissions reduction	0.000	0.429	0.553	39.143	0.553	6.786	1.105	46.357
Green awards	0.000	0.000	0.105	0.750	1.895	5.786	2.000	6.536
Green innovations	0.000	0.179	0.053	0.286	1.000	6.464	0.974	6.929
Green lawsuits, crimes and compensations	0.079	0.536	0.000	1.214	0.368	2.250	0.500	4.000
Environmental incidents	0.000	0.036	0.026	0.607	0.079	0.464	0.143	1.107
Environmental certifications	0.000	0.000	0.000	1.429	0.763	7.107	0.737	8.536
Financial benefits	0.132	1.250	0.026	0.286	0.316	0.929	0.474	2.464
Financial costs	0.026	0.179	0.000	0.000	0.105	0.036	0.132	0.214
Competitive advantages	0.000	0.000	0.000	0.321	0.105	0.429	0.105	0.750
<i>Total items</i>	0.237	3.179	1.684	134.893	6.158	41.679	8.011	179.750

disclosure in monetary terms. However, despite annual reports, there are examples of monetary quantification for various items.

The overall proportion of quantitative non monetary disclosures ranges from an average of 81 % in sensitive firms to 64 % in financial firms and 66 % in manufacturing/service firms. While monetary disclosure is negligible in all sector groups (1 % for sensitive and manufacturing firms and 6 % for financial firms), the extent of narrative disclosures seems to vary from 36 % in manufacturing/service groups to 17 % in financial firms.

The Relation between Environmental Strategies and Environmental Performance. The relation between environmental strategies and environmental performance can be analysed by comparing their own disclosure levels in annual reports and in social reports.

In annual reports, the level of environmental strategies is higher than environmental performance. Despite strategic and operational efforts, sensitive firms generally have environmental performance proportionally worse than other firms. This trend is also indicated by findings about 'operative items' such as 'Waste reduction', 'Consumptions reduction' and 'Emissions reduction'. For these items, the disclosure of environmental initiatives (respectively equal to: 4.286; 6.143; 7.000) is significantly higher than the disclosure of environmental results (respectively equal to:

Table 9 Mean number of annual report environmental performance disclosure by sector groups and level of quantification

Level of quantification of disclosure	Sensitive		Manufacturing/ service		Financial	
	Annual report	Social reports	Annual report	Social reports	Annual report	Social reports
Quantitative monetary	0.571 (3.63 %)	5.857 (1.26 %)	0.263 (3.03 %)	0.917 (0.92 %)	0.000 (0.00 %)	4.111 (6.35 %)
Quantitative non monetary	3.000 (19.09 %)	379.000 (81.66 %)	1.737 (20.00 %)	62.167 (66.22 %)	0.833 (31.23 %)	42.000 (64.61 %)
Narrative	12.143 (77.28 %)	79.286 (17.08 %)	6.684 (76.97 %)	36.833 (36.86 %)	1.833 (68.77 %)	18.889 (29.04 %)
<i>Total mean disclosure</i>	15.714 (100 %)	464.143 (100 %)	8.684 (100 %)	99.917 (100 %)	2.667 (100 %)	65.000 (100 %)

0.571; 1.429; 2.000). Manufacturing/service firms do not show a difference in relation to these items as high as initiatives and results disclosure.

These results, however, judged in the light of evidences from social reports, show that different level of disclosure between items on environmental actions and environmental performance are derived from disclosure decisions on environmental performance of firms that chose to report some information in annual reports and other information in social reports. Thus, in sensitive firms the disclosure of items such as ‘Waste reduction’, ‘Consumptions reduction’ and ‘Emissions reduction’ is relatively low in annual report but very high in social reports (respectively 179.00; 91.143; 126.429).

These finding imply a relationship between environmental strategies and environmental performance. In this way it is possible to correlate the behavior of firms with reference to decisions about environmental strategies disclosure and environmental performance disclosure [86].

Disclosure decisions on environmental strategies range from absent level (where the firm disclosure is negligible with no items in annual reports) to high level (where the firm disclosure is higher than the mean number in its own sector group) and low level (where the firm disclosure is lower than the mean number in its own sector group). At the same time, environmental performance disclosure decisions range from absent level (where the firm disclosure is negligible with no items in annual reports and no social reports of no items in social reports) to high level (where the firm disclosure in overall reports is higher than the mean number in its own sector group) and low level (where the firm disclosure in overall reports is lower than the mean number in its own sector group).

In Fig. 2, by integrating environmental strategies and performance disclosure decisions, we grouped the sample firms in six main groups with only two outliers (Table 10).

The largest group is ‘green approacher’ collecting manufacturing/services and financial firms with low level of environmental strategies disclosure and no

environmental performance disclosure. The features of this group suggest, consistently to prior studies on Italian environmental disclosure [42], that many firms only recently embraced environmental strategies whereby a low level of environmental performance disclosure reflects insufficient environmental results [65, 88, 87].

A large group is also ‘green pragmatic’ collecting manufacturing/services and financial firms with low levels of environmental strategies disclosure and high levels of environmental performance disclosure. The behavior of this group could probably be treated as the ‘legitimacy disclosure’: the disclosure reflects the firm as it is [9].

The group ‘green legitimizing’ represents sensitive and manufacturing/services firms with high levels of environmental strategies and low levels of environmental performance disclosure. Different from the ‘green pragmatic’ group, firms’ behaviors, despite of good environmental performance evidenced by their certifications, awards and inclusion in specific ratings, could be treated as the ‘legitimization disclosure’: the disclosure reflects the firm as it would like to be seen [9, 11].

The group ‘green stars’ represents sensitive and manufacturing/services firms with high level of environmental strategies and environmental performance disclosure. Firms in this group have the highest level of environmental disclosure. These high disclosure in environmental aims, actions and results suggests, opposite to Hughes et al.’s [9] findings consistent to van Staden and Hooks [8], that is that poor performers do not always make the most disclosure since all these firms have an environmental certification, received green awards and are included in green ratings.

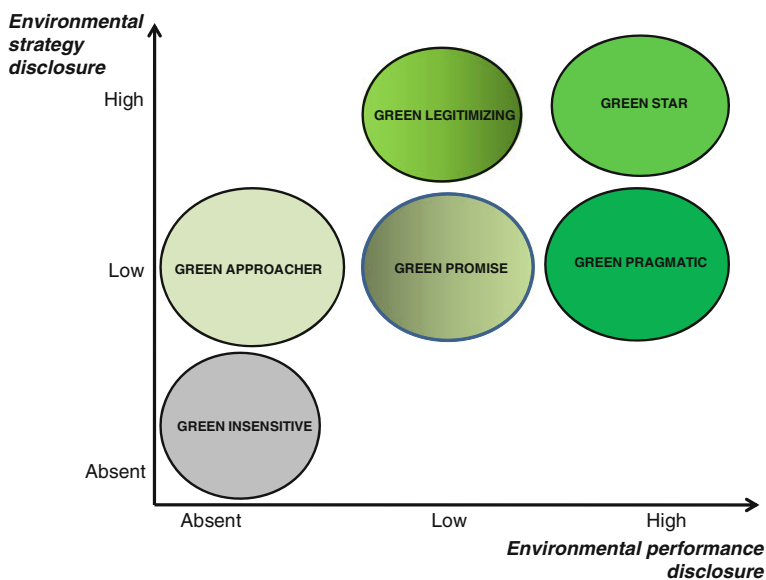


Fig. 2 Environmental strategies and performance disclosure decisions: Italian firms’ practices

Table 10 The disclosure policies of environmental strategy and environmental performance in the sample firms

<i>Environmental strategy disclosure</i>	<i>High</i>	Ansaldo	<i>Green legitimizing</i> Eni, Finmeccanica, Impregilo, Lottomatica, Saipem	<i>Green Star</i> A2A, Atlantia, Enel, Fiat, Snam rete gas, Terna
	<i>Low</i>	<i>Green approacher</i> Banco popolare, Bulgari, Campari, Exor, Generali, Luxottica, Mediaset, Parmalat	<i>Green promise</i> Pirelli, Banca Pop. Milano, STM, Tenaris, Ubi, Unicredit	<i>Green pragmatic</i> Autogrill, Banca MPS, Buzzi Unicem, Fondiaria, Intesa San Paolo, Prysmian, Telecom
	<i>Absent</i>	<i>Green insensitive</i> Azimut, Diasorin, Mediobanca, Tod's	Mediolanum	
		<i>Absent</i>	<i>Low</i>	<i>High</i>
		<i>Environmental performance disclosure</i>		

The group 'green promise' represents firms of all business types with low levels of both environmental strategies and environmental performance disclosure. These firms are investing in green management and are starting to disclose some environmental results, probably a good basis for future good environmental results and disclosure [65].

Finally, the group 'green insensitive' comprehends manufacturing/services and financial firms with no environmental strategies disclosure nor environmental performance disclosure. These firms have not recognized the legitimacy and importance of the biophysical environment in the formulation of organization strategy and in performance disclosure [80].

6 Conclusions

The aim of this paper was to contribute towards the empirical understanding of disclosure practices of environmental strategy. To do so, it used a literature review and a content analysis of corporate reports published by a sample of firms categorized in three main sector groups (sensitive, manufacturing/service and financial). Furthermore, by integrating theoretical and empirical findings, this paper also aimed to improve environmental performance disclosure practices.

In addition to potential limitations inherent to content analysis such as the quantification metric used, the objectivity of the measurement, and a focus only on written disclosure, our empirical analysis has other limitations due to the relatively small sample size that makes generalizations more difficult. However, consistent

with the aims of interpretive studies [73], this paper provides results and their tentative interpretations to help shedding some light on environmental strategies and performance practices of Italian firms. First, by detailing a literature review and the analysis of environmental models and by clarifying environmental strategies and green management concepts, we advanced a framework on green management. This contribution is relevant both for strategic management and performance measurement studies on environmental issues. Second, we found that sensitive firms recognized the legitimacy and importance of the biophysical environment into the strategic process. However, within the same sector group there is high variability in environmental strategies. Third, we provided some evidence of the relationship between environmental strategies and performance, a theme in need of more in-depth research. Since disclosure on environmental strategies is wider than environmental performance disclosure, future research can investigate whether it depends on: firms decisions related to the satisfaction of stakeholder pressures more than to effectively improve their environmental performance [59]; time needed to achieve good environmental results [65]; difficulties in environmental performance measurement [4]. Finally, by integrating theoretical insights and empirical findings on best practices, we suggested some improvements of environmental performance disclosure in order to balance stakeholder needs with shareholders views [88, 89].

The analysis on the level of quantification shows firms that rely mainly on environmental qualitative and/or non financial measures and suggests that these firms do not have the relevant information to accurately capture their environmental performance. Moreover they do not offer external stakeholders the possibility of an effective evaluation of environmental strategies.

Italian firms have non homogenous behaviors in environmental strategy disclosure and follow only partially global standards. Thus, for external stakeholders is not easy to compare environmental performance of several firms by looking at annual reports and social reports disclosure [7]. Consistently to Ilinitch et al. [58] performance indicators may be tailored to reflect issues faced by the individual company or industry. Future studies could investigate the determinants of variability in environmental performance disclosure.

Opposite findings of prior studies on the relationship between environmental strategies and environmental performance could therefore be affected by different behaviors of firms in different sectors. These findings may push researchers to a deeper exploration of the need for reporting and performance measurement alignment to obtain effective value drivers and performance indicators of environmental strategies.

Our proposed framework offers a broad perspective on environmental strategies and environmental benefits because costs and competitive advantages are more effectively identified and measured in the strategic process. Environmental strategies must be formulated by integrating environmental issues in corporate ideas and goals. Each item of environmental strategies must be translated in environmental actions and linked to environmental metrics. Accordingly, an effective disclosure of environmental strategy may be structured in three levels: general,

sector-specific and firm-specific. Nevertheless, in order to obtain meaningful information on environmental performance, it is necessary to achieve a sufficient degree of spatial and temporal comparability of environmental disclosure. To do this, we suggest the improvement and diffusion of rigorous standards related to the process of both individuation and communication of environmental performance.

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The Role of Continuous Monitoring of Internal Controls over Financial Reporting: A Case Study of an Italian Medium-Sized Company

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Abstract This chapter aims to analyze the academic and professional utilization of continuous monitoring (CM) with subsequent tentative implementation in a medium-sized Italian company. The study focuses on the possible role of CM techniques in the system of internal controls over financial reporting. The primary research questions are as follows: (1) Are recent regulatory changes related to corporate governance creating opportunities to implement the CM approach? (2) What are the obstacles to applying the CM techniques in the Italian corporate governance model and the market for audits of accounts? and (3) What is unique about applying CM to small and medium-sized organization in the current IT environment? Using a case study method can provide initial answers to those questions and indicate possible firm-level benefits of CM (i.e., efficiency, better decision making, and cost savings) as well as benefits for stakeholders (i.e., more reliable financial reporting).

Keywords Continuous monitoring • Internal control systems • Accounting information system • Financial reporting • Continuous auditing • Corporate governance • SMEs

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1 Introduction

It is widely accepted that business organizations are affected by their environment. The term “environment” includes various aspects, including political, cultural, social, economic, financial, regulatory, and technological dimensions. From the corporate law perspective, it is significant that the regulatory context is essentially constantly evolving through European Union directives and recommendations and through reforms of domestic legislation that are intended to improve corporate governance and protect the interests of different stakeholders: shareholders, employees, and creditors. Some of the recent changes emphasize the role of the “internal control system” in the process of producing financial reporting (e.g., in the U.S., the Sarbanes–Oxley Act of 2002, Sect. 404). We focus on this factor in evaluating the framework for more effective corporate governance, including internal and external monitoring actors (boards of directors, boards of statutory auditors or supervisory boards—*collegio sindacale*, internal auditors, and external auditors). Among these actors is information technology (IT), including both its technological and informational aspects. In combining the legal requirements regarding internal control systems with the benefits offered by IT, a business organization can effectively react to the information age.

In fact, business organizations and internal communications are inevitably immersed in a process of change that derives from the opportunities offered by IT resources (e.g., enterprise resource planning—ERP—or the Internet). In general, large companies are interested in this change process, which also has consequences for the role played by financial and management accountants in the profession and in the relevant research [3]. The process of wealth creation is also affected by IT, which affects production, financing, distribution, and human resources. A wide array of examples of companies who manage key processes in real time are reported in Vasarhelyi et al. [2]. These authors also show that internal control systems for financial reporting, whether simple or sophisticated, are an example of this trend. Corporate control systems for production, marketing, and research and development have also been developed and automated. As the latter change has occurred¹ and most corporate control systems have become less directly observable, the need to monitor these systems has emerged. This monitoring,² a progressively important activity, is now called continuous control monitoring (CCM) [3].

The case study that we present in this chapter is a good experimental setting for at least two reasons. First, this company (Ceramica Catalano S.r.l.) has recently invested in developing an automated production process, with a strong emphasis on the quality of the end product. This cultural and technological emphasis allowed us to focus on additional aspects of the firm that were linked to operational and financial monitoring. We intend to explore the specific impact of continuous

¹ Configurable controls in large ERPs can involve tens of thousands of basic actions, many of which users can adjust.

² Such monitoring is intended to ensure that the control systems are active and effective.

monitoring (CM) technology for internal control systems as a means of obtaining better-quality information, improving management accounting tools, and consistently taking advantage of IT innovations. However, such systems may be risky if these internal mechanisms are not fully integrated (or accepted) into the corporate culture. This lack of acceptance would reduce the advantages of the flexibility derived from IT innovation.

The second reason is the shift in interest from large corporations to small and medium-sized enterprises (SMEs). The latter are important in the European Union (EU) and in the economic context of Italy. More than 99 % of all European businesses are, in fact, SMEs. Such firms provide two out of three private sector jobs and contribute more than half of the total value added created by businesses in the EU. Moreover, SMEs are the true backbone of the European economy, as they are primarily responsible for wealth and economic growth and also play a key role in innovation and R&D.³ The literature has revealed that SMEs address IT in specific ways depending on the organizational context [4]; moreover, the acquisition of IT in SMEs mainly occurs through program management outsourcing and depends heavily on external expertise [5].

The case study is founded on the view that the role of human resources inside an organization remains crucial in helping the firm to manage the transition to a dynamic information system and a CCM approach. Any IT innovation requires high-quality labor, regardless of the company size. The fundamental concept is that labor and IT tools work together to improve business performance. The CM of internal control systems for financial reporting is an extension of the changes to other business process (e.g., automated production), and those that have occurred in other spheres of human activity. As Brynjolfsson and McAfee [6] put it, “in medicine, law, finance, retailing, manufacturing, and even scientific discovery, the key to winning the race is not to compete against machines but to compete with machines. While computers win at routine processing, repetitive arithmetic, and error-free consistency and are quickly getting better at complex communication and pattern matching, they lack intuition and creativity and are lost when asked to work even a little outside a predefined domain”.

One of the objectives of this research is to explore the benefits of CCM for business processes. Just as the quality of a product depends on the process used to eliminate defects before the product is finished, the quality of financial information depends on the internal procedures used to generate the data. CM is one of the elements of an overall management control system package. In this context, the primary research questions are as follows: (1) Are recent regulatory changes related corporate governance creating the opportunity to implement the CM

³ See http://ec.europa.eu/small-business/index_en.htm According to the European Commission Recommendation of May 6 2003, the category of micro, small and medium-sized enterprises is made up of enterprises that employ fewer than 250 persons and that have an annual turnover that does not exceed EUR 50 million and/or an annual balance sheet total that does not exceed EUR 43 million. Within this category, the Recommendation provides specific definitions of small and micro firms.

approach? (2) What are the obstacles to applying the CM techniques within the Italian corporate governance model and within audits of accounts? and (3) What is unique about the application of CM in SMEs in the current IT environment? Using a case study method can yield initial answers to those questions and indicate the possible benefits for organizations using CM (i.e., efficiency, better decision making, and cost savings) and their stakeholders (i.e., more reliable financial reporting).

The remainder of the chapter proceeds as follows. [Section 2](#) addresses the different definitions of CM and the different approaches that have been used in the literature, with special attention to SMEs. [Section 3](#) describes the Italian institutional framework, considering the role of accounting and the possible contribution of CM in this regard. In this section, we also present the governance model for a private limited liability company in the Italian context, providing a tentative answer to the general question of whether there is space for CM in the Italian regulatory system. Finally, we present the case study, which allows us to analyze the steps involved in introducing CM procedures and a CM program into the information system at the company that is the object of our research. In this section, we analyze internal control, CM and corporate governance, CM and just-in-time inventories, CM and dashboards, corporate performance reporting, balanced scorecards, online/real-time alerts that allow firms to take timely, efficient action during their operations, and the reliability of the resulting financial reporting. Our conclusions are presented in the last section.

2 Continuous Monitoring

The monitoring of business has always been an intrinsic part of the organized business production process. The production of a good or service is always bolstered by organizational provisions for measuring, monitoring and re-evaluating the process [7]. The monitoring of organized activities was mainly visual and manual until the progressive introduction of computer technology into business operations. The continuous monitoring (CM) of business processes includes 4 main elements [8]:

1. Measuring the actual business process;
2. Establishing a basic standard to use to compare/evaluate the business process;
3. Comparing the absolute value of (1) minus (2) with a standard of acceptable variance; and
4. Establishing methods of alerting the firm about potential issues.

Business monitoring, which is mainly a management activity [9], differs from assurance in that it aims to ensure that business processes are performed as aimed.

Business assurance, which is mainly an auditor activity, aims to verify that business measurements are reliable and accurate. [Figure 1](#) presents a hierarchical

Fig. 1 Meta-planes of action



set of planes of action that includes goals and achievements as well as control objects and activities.

The controls and the comparison between the standards or goals and the actual outcomes allow alerts to be generated when necessary, which in turn lead to the relevant process adjustments and corrections.

Figure 2 represents a more complete cycle of business activities progressively measured to facilitate the operation of the firm. This level of formalization of business activity requires a substantially expanded measurement framework in which complex non-deterministic measurements are progressively used to achieve the goals at each level.

The goals and results associated with each level in Fig. 2 allow for control and progressive performance. These basic elements of the empirical relational system are analyzed using the extant information technology—from manual to highly automated tools depending on the formalizability and economics of the processes. The economics of formalization is contingent on the size of the organization and, consequently, the frequency with which a function is repeated. A seldom performed function cannot be easily automated.

The current environment for continuous audits is one of progressive adoption, typically by large firms in critical functions. [11] However, adoption is still limited and casuistic. Furthermore, adoption is limited to very large organizations with budgets for R&D and deep management capabilities. Nevertheless, SMEs also (and perhaps even more urgently) require continuous assurance [2], including continuous data audit (CDA), continuous control monitoring (CCM) and continuous risk monitoring and assessment (CRMA). These firms typically lack the technical competences to take advantage of technology and resources and to develop such solutions. With this distinction in mind, we will now address some considerations that are specific to SMEs in relation to CA/CM.

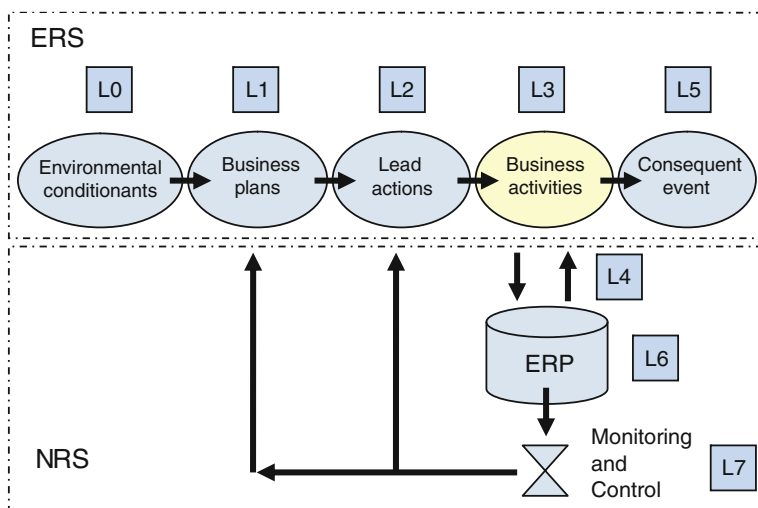


Fig. 2 Business activity measurements (Adapted from [10])

1. The governance of SMEs is likely to require the support of CA/CM even more urgently than that of large corporations;
2. Such firms face many obstacles, particularly capital intensity and technical competence. It can be postulated that CA/CM systems for SMEs should be provided by producers of packaged software that provides accounting, finance, and marketing functionalities but also fosters the monitoring capabilities that firms require in the 21st century;
3. Because these capabilities will be pre-packaged, competent usage rather than availability will provide the desired competitive advantage;
4. The inclusion of supporting “software agents” in CA/CM for SMEs can counterbalance the aforementioned deficiencies;
5. Governments should take an active role in supporting the development of CA/CM for SMEs.

3 The Italian Institutional Framework: Are There Opportunities for CM and CA?

The prospect of implementing the continuous auditing (CA) and continuous monitoring (CM) as part of the corporate governance of SMEs is problematic within the Italian institutional framework for several reasons. As stated in Sect. 2, CA is assumed to be a continuous verification process for which auditors are responsible, whereas CM is assumed to be a continuous process that is intended to monitor the internal control system used by a firm’s management.

One issue, then, is what conditions make these control processes applicable in the context of small organization given that control monitoring does not necessarily require an auditing process but instead could be used regardless of whether there is an external verification process. It is also important to note that the concepts underlying control activities are the same across companies of different sizes, although the documentation can be presented in a simplified form for SMEs [12, 13].

The monitoring of control systems by management is often achieved through the close involvement of the management or the owner-manager in operations, which allows the individual in question to identify any significant weaknesses in the internal control system. An auditor is then required to reveal the main activities used by the company to monitor its internal control system in preparation for financial reporting [12].

The process of applying CA within SMEs requires a clear definition of these systems of corporate controls. Legislative Decree No. 39 of 2010 has unequivocally confirmed that the “control” is an audit process (i.e., a full audit) within all companies. If SMEs did not require “audits”, we could not logically discuss CA as a variation on the traditional audit for SMEs.

CA involves the automated, continuous collection of evidence to evaluate the entire system of business transactions rather than to conduct random ‘spot checks.’ It is obvious that the proper monitoring of internal control systems by management should result in less effort on the part of the auditor. Given these requirements, a precondition for continuous monitoring is the existence of an adequate information system and specifically the administrative and accounting procedures involved in producing financial reporting, which is highly automated.

The Italian regulations (art. 155 Legislative Decree No. 58/1998 and art. 2409-ter civil code) regarding the frequency (at least quarterly) of inspections during the accounting period are reasonably designed to inform the management and corporate governance bodies of unintentional errors, fraud, and deficiencies in a timely manner and as prescribed by international auditing standard no. 260. The aim is for the firm to be able to take the necessary remedial action before financial statements are involved, thus making the entire audit process proactive in a sense. This periodic verification is consistent with the CA process [14]. However, the implementation of CA and CM requires mostly automated environmental controls that are not always found in SMEs [15].

3.1 Oversight Systems in Italian Limited Liability Companies

Following the reform of corporate law, limited liability companies can opt for one of the following three administrative and oversight systems: the traditional (or Latin) model, the two-tier model, or the one-tier model. Within the three models, the oversight function is subdivided into two areas: administrative oversight and accounting oversight. In this chapter, we consider the traditional model

because it is the most often used by Italian companies,⁴ including our case study company. We consider unlisted companies to be subject to the regulations of the Civil Code (c.c.).

Italian law permits the so-called two-tier and one-tier models as an alternative to the traditional one only if company statute requires it. If the statute does not stipulate otherwise, art. 2380 c.c., paragraph 1 requires that *administrative and company oversight* be regulated according to the traditional model. Thus, the traditional model seems to be the one preferred by Italian legislators.

Although the administration (the administrative body in this model) also conducts oversight in a broad sense as well as managerial activity, the subjects that are institutionally delegated to supervise the firm are the board of statutory auditors (the internal company body or “*Collegio sindacale*”) and the auditor (normally an external body).⁵ In private limited liability companies, the board of statutory auditors is a monocratic internal body called the “*Sindaco unico*”.

The former, pursuant to art. 2403 c.c., has the task of controlling *observance of the law and statute, respect of the standards of correct administration, and in particular the adequacy of the organizational, administrative and auditing structures adopted by the company and its actual functioning*. This is what is referred to as *administrative oversight or substantive legitimacy oversight*. The auditor, pursuant to art. 14 of Legislative Decree No. 39 of 2010, is responsible for the auditing, the ultimate aim of which is to evaluate the consistency of the financial statements with the most current auditing standards.

It is therefore clear that one feature of this model is the separation of the auditing function from the so-called administrative oversight function. In fact, the Italian legislation has sanctioned the separation of administrative oversight from accounting oversight (financial auditing). The auditor’s report must now, in fact, include the auditing standards used and must describe the nature and extent of the audit, indicating that it has been performed according to auditing standards. It is now certain that the content of the audit is consistent with the international auditing standards (art. 11, Legislative Decree No. 39 of 2010). If the board of statutory auditors at an unlisted company (a *collegio sindacale* or *sindaco unico*) is in charge of auditing the accounts, the board will be required to perform a full audit.⁶

⁴ See *Il Sole 24 Ore Norme e Tributi* of June 16, 2008 n. 165, which used as its source InfoCamere data as of June 9, 2008.

⁵ Unless auditing is by law entrusted to the board of statutory auditors, it is conducted by an external body that, depending on the situation, can be an individual auditor or a registered auditing firm. The statutory board of auditors can also perform the audit in addition to providing administrative supervision according to art. 2409-2, paragraph 3 when the following conditions apply: there is an explicit statutory provision that assigns the responsibility for auditing to the board of statutory auditors, the company does not make use of the regulated equity market, the company is not required to publish a consolidated balance, and the statutory board of auditors is composed only of certified financial auditors.

⁶ In the other corporate governance systems, the actors that are institutionally required to conduct the financial audit are always represented by the appointed external auditor.

4 The Implementation of Continuous Monitoring Procedures in an Italian Medium-Sized Manufacturing Company

Continuous monitoring and continuous auditing are emerging in Italy as potential tools that managers and auditors can use to manage their responsibilities within corporate governance [10]. This interest is a function of (1) the development of a culture that is oriented toward improving internal controls and risk management [16, 17] and (2) a progressive regulatory push toward ensuring the effectiveness of control activities by supervisory boards (*collegio sindacale*) and statutory auditors.

In particular, in the last decade, a *culture of internal control* has become widespread in listed companies, which have been called upon to comply with certain rules to regain and ensure investor confidence, especially with regard to system management risk and internal controls over the financial reporting process. In fact, the corporate governance standards of Italian listed companies [18] in terms of internal control are consistent with international best practices [17, 19]. In unlisted companies, however, there is an awareness of the issues regarding internal control that have been generated by the introduction of laws regarding administrative liability for firms (Legislative Decree No. 231 of 2001). This particular law requires the development and adoption of a model of risk management for preventing crime, including financial infractions (e.g., fraudulent financial reporting). However, the constant improvement of internal controls has become standard even in unlisted companies, as administrators need to be familiar with and assess the components of internal control within their organizations.

Regarding the *effectiveness of control activities*, it is important to note that for unlisted companies, recent regulatory changes have imposed a new framework of internal controls that influence the corporate responsibility of supervisory boards (*collegio sindacale*) and statutory auditors. In particular, as part of its administrative supervisory function, the supervisory board (*collegio sindacale*) is required to monitor and release periodic reports on the reliability of the organization given the size and the complexity of its business. The parameters on which the organizational structure of the company is evaluated are accountability, separation of duties, checks and balances, the security and functionality of the information system, and monitoring mechanisms for internal control activities used to oversee the company's accounting system.

The new statutory audit regulations make it mandatory to carry out audits based on the principles of review; the evaluation of the internal control system during each phase of the audit process (planning, performing verification, opinion) is required. Continuous monitoring and continuous auditing could therefore be helpful for Italian unlisted companies; in these firms, strengthening the understanding and evaluation of internal control systems is an ongoing challenge for both boards of directors and auditors.

To analyze the potential of continuous monitoring and continuous auditing in unlisted Italian SMEs, we have used the case study method [20, 21, 22]. The case

studies analyzed in this chapter originate from a research project entitled “Process innovation and continuous monitoring” that was launched in early 2012 by the Department of Economics and Management at the University of Tuscia—Viterbo and the company Ceramica Catalano S.r.l.

For several years, the Department of Economics and Management has tried to develop models of control of production processes that make it possible to monitor costs simultaneously and thus determine the relationship between the yield and the profitability of production processes and products, particularly in the ceramic industry [23].

Ceramica Catalano S.r.l. is an Italian bathroom furniture industry that was founded in 1967. The company sells its products in more than one hundred countries around the world and stands out compared to its competitors in terms of the quality and design of its products [24]. The project is intended to analyze how ceramic production processes interact with a highly automated information system and accounting system and to evaluate the potential to develop a flow of information that would be typical of continuous monitoring.

In addressing what is unique to the use of CM in SMEs in the current IT environment, we have asked the following detailed questions:

1. What are the conditions that make it possible to begin a continuous monitoring process in an Italian manufacturing SME?
2. What are the steps in the technical implementation of continuous monitoring, and what management areas are involved?
3. What opportunities for continuous auditing may also be related to the financial reporting process? [25].
4. Who could benefit from the use of the information provided by continuous auditing?

We have conducted our research by analyzing the company’s internal control system, gathering evidence, analyzing databases, conducting observations, asking questions and conducting case reporting. Our findings and analysis are summarized in the subsequent sections.

4.1 Conditions for the Adoption of CM in Italian SMEs

Regarding the conditions that allow the introduction of continuous monitoring, in addition to those described in Sect. 2, we should also comment on specific issues that affect Italian manufacturing SMEs. The governance of these companies is characterized by poor separation between the owners and the administration or management [26], a strong link with local industrial district, a control environment in which the opposition between managers and controllers is limited, and weak formalized systems of internal control and risk management exist.

Continuous auditing techniques can be adopted by firms characterized by the following:

- A corporate culture that extends beyond “family” relationships between owners, managers and employees and an internal control environment characterized by ethical values and rules that ensure professional governance and performance evaluations, transparent operations and a robust financial reporting system;
- A corporate information system that is able to collect, store, process and distribute data using an advanced computer system that can conduct continuous monitoring. Such a system will allow the management to continuously analyze their compliance levels and the performance of their business processes with reference to their expected levels of efficiency and effectiveness.

For these reasons, it was appropriate for us to select Ceramica Catalano S.r.l. as our case study firm. With regard to the firm’s corporate governance and control environment, the following information is relevant:

The firm is a limited liability company whose administration is entrusted to a board of directors that consists of three members and delegates authority to a single executive director, the CEO. The CEO is a minority shareholder of the company. The control function is entrusted to a supervisory board (*collegio sindacale*) that is also in charge of the statutory audit process. There is no an audit department. The company is owned by 25 shareholders, all of whom are employees or ex-employees of the company; no one directly or indirectly holds the majority of the shares. The company’s production site is in Italy, in the ceramic district of Civita Castellana in the province of Viterbo, and the firm employs a highly automated production process. The company has developed a quality manual and uses processes that are ISO 9001:2008 certified. The firm also constantly attempts to ensure the environmental sustainability of its production processes and its products.

In recent years, in developing its corporate information system, the company has invested significantly in production technology by developing industrial synergies with major production facilities in the ceramic field. These investments have resulted in the highly organized, automated processes that the firm uses today, which are supported by software programs that can generate both qualitative and quantitative information for each individual phase of the production process.

The company has not yet adopted an ERP solution [28]; it relies on a management reporting system that is based on database processing according to the information needs of the individual management areas (production, sales, administration, and payroll). At the end of 2011, the company had approximately 270 employees and had annual sales of approximately €40 million, selling its products in more than 80 countries. This productivity has made Ceramiche Catalano S.r.l. the largest exporter of bathroom fittings made in Italy.

4.2 Steps for Developing a Continuous Monitoring Approach

In this sub-section, we analyze the phases of development for CM. The starting point for our research is the analysis of production processes (I), from raw materials to finished products, including the design phase. The analysis process,

when carried out in a timely manner, can determine the performance of each process relative to the resources utilized. The analysis makes it possible to link the results obtained during the individual steps in the production process to the different types of costs (direct and indirect) of the product. Generally, in traditional accounting systems, indirect costs are charged to cost centers in aggregate and are assigned to specific activities within the production process.

After the above analysis, one can continuously identify the trends in the process (II) with reference to production and costs. In this context, it is necessary to identify the key controls, both in terms of the yield of the production process (the quality of the product in the processing phase) and the efficiency of the activities (the cost during the processing phase). This analysis will make it possible to develop a CM system that can improve planning and control.

The monitoring system should be based on a reporting system (III) that is capable of measuring the previously identified indicators. These include

- The cost of the product and the batch according to the ABC method [28];
- The number of non-conforming products (defective products, repaired products, II choices) in each stage of processing;
- The cost of non-compliance in each stage of processing;
- Deviations from the standard costs and budget; and
- Financial analysis scenarios.

It is then necessary to identify the users and to determine the format and frequency of the reported information. The purpose of reporting within information systems is to provide analytical documentation on meaningful activities. Such disclosures should be as updated and correct as possible and therefore should not generate inconsistent interpretations.

After the above activities have been completed, the aim is to re-design the IT system (IV). In this way, for “every point in time,” the company can identify the cost of each product and its contribution to the operating results in all phases of the process, taking into account deviations, the causes of variations, and the impact on the marginal product.

The start of CM is linked to an architectural approach within the information system. The firm must consider the following questions:

- What database (DB) should be used? In our case study, the company uses a transactional database that can, in turn, be used to develop an analytical DB or ERP system, possibly supplemented by external data sources and processes (associations, institutional databases, market analysis, or others);
- What tools provide the information? CM requires a firm to use the reports prepared by the transactional database as well as new forms of communication through reports, dashboards for workstations and mobile devices, or multidimensional cubes processed by analytical databases or data warehouses;
- What security and assurance systems should be used for the data? Data security is a significant challenge: more information generates more value for those who use it, but confidential data also generate risks and have legal implications. To

ensure the reliability of the data, CM must be supplemented by data validation mechanisms that can provide an adequate level of assurance. In addition to periodic checks that indicate the reliability and security of the software, warning indicators can be provided for continuous data assurance.

Once the system is in place, CM will allow the company to constantly monitor the system of production and will provide dynamic information on compliance with production standards and budgets. The benefits of implementing the continuous monitoring approach for Ceramica Catalano S.r.l. could include the following:

- Leveraging technology and automation to identify and quantify the risks associated with the process;
- Creating dashboards for monitoring risk and performance;
- Taking immediate action in high-risk areas to achieve planned levels of performance;
- Improving internal controls by using continuous dynamic information rather than static analysis;
- Performing targeted testing to assess the effects of risk processes;
- Communicating the results of the monitoring process within the organization to raise awareness among employees and suppliers about the characteristics of specific manufactured goods.

Strengthening the above knowledge will also allow significant improvement in existing products and processes. This procedure is therefore intended to help firms design, establish and apply a model of internal control for their industrial processes that allow effective monitoring and efficient performance. This management tool can be considered an innovation in the management of production systems in the ceramic industry.

Consistent with this statement is a recent document released by the *Consiglio nazionale dei dottori commercialisti ed esperti contabili* (the Italian CPA institute) on “The application of international auditing standards to SMEs” [12] that addresses evaluation and monitoring tools adopted by audited companies. In particular, regarding the planning of statutory audits and the assessment of control risk, the document indicates that “the monitoring of controls is a process over time to evaluate the effectiveness of internal control system. This activity consists in the timely evaluation of the effectiveness of controls and in taking the necessary corrective actions. The management is monitoring of controls through ongoing activities [...] The auditor obtains an understanding of the main activities used by the company to monitor the internal control over financial reporting and writing in particular those concerning the control activities relevant to the review, and includes how the company takes corrective action with respect identified weaknesses in their controls.”

Document [12] indicates that, regarding compliance procedures, *the auditor may obtain audit evidence to determine whether changes were made to the automated control that affect the continuous and effective operations*. Clearly, continuous auditing is not directly referenced here, but it is recognized that CM

could be a significant element of the internal controls used by SMEs. Another useful document is a questionnaire that auditors used to address internal control systems, no. 10 [12], which determines whether there is a series of internal controls in place to oversee the reliability of financial statements.

Table 1 indicates that in the case study analyzed, some controls can be effectively made automatic. However, this is not the case for others because of concerns regarding continuous monitoring; for now, only the accounting related to the production areas (passive cycles, fixed assets and inventory) can be addressed in this manner. In the last column, we indicate the frequency of the checks.

Obviously, the use of automatic controls and their reliability is linked to the risks associated with IT systems. For this reason, systematic assessments of the reliability of the IT environment are required. Relevant considerations include whether off-the-shelf software is used, how data and systems are accessed (authentication and credentials), the appropriateness of the authority levels assigned to various users and of their roles and responsibilities, and the physical security of the servers. Understanding these issues is essential to understanding and evaluating the reliability of an IT system.

Finally, it is important to consider the corporate actors that can benefit from the CM approach. The board of directors and CEO, who will have access to an immediately usable tool for firm governance, are among these actors. Other affected actors include departmental managers, who will have the real-time information that they need to act in critical business areas and an information system accepted by the entire organization, as well as the firm's supervisory board

Table 1 Applicable automatic controls according to the CDNC questionnaire on the internal control systems for statutory audits in SMEs

Control activities	Automatic key controls	Frequency report
<i>Procure to pay</i>		
All purchases are authorized	Applicable	Daily
We accept only the goods and services ordered	Applicable	Daily
The receipt of goods and services is adequately monitored	Applicable	Weekly
Returns and claims against suppliers are monitored	Applicable	Weekly
Invoices are properly reviewed and approved	Applicable	Weekly
All purchase transactions made are recorded	Applicable	Monthly
Purchases are recorded as they are received	Applicable	Monthly
Payments to providers are properly authorized and recorded in a complete and accurate manner	Applicable	Daily
<i>Fixed assets</i>		
The existence of fixed assets and their physical and operational status are periodically checked	Applicable	½ annually
<i>Inventory</i>		
Work in progress is monitored	Applicable	Quarterly
Inventory that is obsolete, slow moving or overstocked is identified	Applicable	Quarterly
The unit costs of the inventory are properly determined	Applicable	Quarterly
Inventories are valued correctly	Applicable	½ annually

(collegio sindacale), which evaluates of the functioning of the internal control system and the evolution of the firm's performance management. Because this board is in charge of the statutory audit process in our case study firm, it may enjoy a higher level of confidence in the accounting information used in the budget management process, undoubtedly influenced by the controls used in CM.

5 Conclusion

In addressing the impact of recent regulatory changes on corporate governance and the creation of opportunities to implement the CM approach, we have focused on two main issues: a) the new statutory audit law (Legislative Decree No. 39 of 2010) and b) the increase in the responsibility of managers for the actual functioning of the internal control system (Legislative Decree No. 231 of 2001). Overall, the Catalano s.r.l. case study shows the relevance of CM. Managers understand the need for CM and its potential benefits as well as the main key risk indicators related to operations management.

The case study shows that the most significant challenge to the application of CM within the Italian corporate governance model is the level of informatization of business processes. The investments in innovations in production processes that the company made in recent years have allowed CM techniques to be used that otherwise could not have been. Moreover, CM is perceived by the management as a tool for corporate governance that can also improve competitiveness.

Regarding what is peculiar about the use of CM in SMEs in the current IT environment, the case study shows that only certain conditions allow the implementation of CM processes. The firm must have an adequate "corporate culture" and "information system," as described in [Sect. 4.1](#). In Catalano s.r.l., CM will be actively used to assess production, control product quality, and evaluate the economic performance of the related process. (These are key performance indicators.)

The case study confirms that CM could be used in the financial reporting process. In particular, CM should improve the reliability of the financial data related to the production process.

Because this research is in the initial phase, this subject will require further analysis. At the end of the CM project focused on Catalano s.r.l., off-the-shelf software could be developed that would be useful to other companies in the ceramic production industry.

This research (1) contributes to an initial discussion of the potential implementation of CM in SMEs given the Italian legal framework and the links with the traditional management control systems; (2) discusses the operations management tools for SMEs and their possible benefits for firms, as well as how a culture of CM and performance measurement can be generated within the ceramics industry in the province of Viterbo; and (3) provides evidence of the possible benefits of CM and thus encourages government policies that would incentivize the use of new IT tools by SMEs in management and control processes.

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Accounting Information Systems and Knowledge Management Systems: An Integrated Approach for Strategic Control

Roberto Del Gobbo

Abstract The aim of this chapter is to highlight the potential role of integration of Accounting Information System (AIS) and Knowledge Management Systems (KMS) for strategic control. The benefits of this integration can be expressed in terms of better support to knowledge conversions and enhanced access to knowledge embedded in tacit models by applying knowledge discovery techniques for model externalization. We propose a modified version of PROFSET model as a tool for realizing the integration: combining elements from AIS (to calculate product profitability) and KMS (to discover regularities in the purchase behaviour of customer), the PROFSET model can enhance the quality of support provided to decision makers and produce benefits that cannot be realized with any one system.

Keywords Accounting information system • Knowledge management system • Profitability analysis

1 Introduction

The success of a business enterprise depends upon how well it adapts to the environment in which it is set [1]. In this sense strategic control plays a central role, since it may be defined as the process by which managers attempt to ensure that their organization adapts successfully to its changing environment [1, 2]. The Accounting Information System (AIS) can be used *effectively* to serve this purpose. Indeed accounting information is provided within organizations as “a means of

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assisting them to adapt their activities so they can continue to achieve their objectives in the face of environmental and internal changes” [3]. Therefore, the AIS should be designed so as to enable effective strategic control of organizational activities to be achieved.

From this point of view, the increasing relevance of knowledge as a critical asset poses a new challenge to AIS that to play a strategic role in decision processes needs to become more consistent to the value creation sources. More specifically, what is needed are systems that go beyond relationships found in information and allow decision makers to extract patterns, trends, and correlations, giving the insight that responds to the changing environment [4]. Many organizations are developing Knowledge Management Systems (KMS), a class of information systems specifically designed to support creation, sharing, and integration of knowledge as opposed to data or information [5]. Despite the importance placed on these knowledge-based systems, recent studies point out a relatively low implementation success rate of these projects [6]. It has been recognized that the economic concepts may play an important role in determining the interestingness of knowledge discovered and assure that it can be use to deliver competitive advantage [7, 8]. Accounting can provide a convenient language for discussing the impact of a pattern discovered and ensure that it is defined in an appropriate way to implement the decisions for which it is being used [3]. In such a manner, the AIS, performing calculations grounded on economic concepts, provides a vehicle for facilitating the application of knowledge created by information technology. Integration of AIS and KMS, therefore, is expected to result in several benefits that cannot be realized with any one system.

The aim of this chapter is to highlight that proper integration of AIS and KMS presents new opportunities for enhancing the quality of support provided by each system for strategic control. The knowledge discovered by KMS enables the dynamic creation and maintenance of decision models. In return, the application and evaluation of various decision models, supported by accounting calculations performed upon economic concepts which characterize an AIS, provide the means of acquiring and storing the tacit and explicit knowledge about the business domain and facilitate the creation of new knowledge. The chapter is structured as follows: in [Sect. 2](#) we briefly describe the theoretical framework in which the integration of AIS and KMS is suited, and we propose the Nonaka’s model of organizational knowledge creation as an approach to highlight the potential benefits of this integration. In [Sect. 3](#) we present the research methodology, and the modified version of PROFSET model, used to determine the total product profitability, taking into account cross-selling effects. Conclusions, limitations and directions for further research are presented in [Sect. 4](#).

2 The Theoretical Framework

The Accounting Information System is considered an organizational mechanism that is critical to support effectively decision making and control in organizations [9]. In prior studies examining multiple indicators of accounting system *effectiveness* [10], the decision-maker's perception of the quality of information outputs provided by the system has been suggested as an important dimension of effectiveness. The concept of "information usefulness" has been extensively examined in the accounting literature [11, 12]. Accounting theorists have long recognized that the accounting information system provides critical decision-influencing and decision-facilitating information for control [13, 14]. From this point of view, the AIS effectiveness can be defined in terms of the ability of the system to provide output information that can be effectively used to respond to control requirements.

But according to Alavi and Leidner [5], information in itself may be of little value; only that information which is actively processed in the mind of an individual through a process of reflection, enlightenment, or learning can be *useful*. The processing of information in the mind of an individual produces what Polanyi [15] refers to as *tacit* knowledge. When articulated and communicated this tacit knowledge becomes *explicit* knowledge. The Knowledge Management Systems are specifically developed to support the acquisition, organization and communication of both tacit and explicit knowledge. KMS are not radically different from existing information systems, but they are extended toward helping in user assimilation of information [5].

Because knowledge is personalized, in order for an individual's or a group's knowledge to be useful for others, it must be expressed in such a manner as to be interpretable by the receivers. Consistent with this view, we can state that information is converted to knowledge once it is processed in the mind of individuals and knowledge becomes information once it is articulated and presented in the form of text, graphics, models, or other symbolic forms. An important implication of this definition of knowledge is that systems designed to support effectively decision-making process will be geared toward enabling users to assign meaning to information and to capture some of their knowledge in information and/or data [5]. The integration of AIS and KMS can serve effectively to these purposes.

Although KMS support not only the creation, but also gathering, organization and dissemination of knowledge, we will focus our discussion on the knowledge creation process. From this point of view, the benefits of integrating AIS and KMS can be represented, at conceptual level, with reference to the Nonaka's model of knowledge creation. Nonaka [16] proposes that new organizational knowledge is created by a dialectical relationship between tacit and explicit knowledge, which emerges into a spiral of knowledge creation consisting of four types of knowledge conversions: *externalization*, *combination*, *socialization* and *internalization*.

The knowledge *externalization* involves the conversion of tacit knowledge to explicit knowledge. In the context of our discussion, this can be viewed as similar to the process of decision modelling, which requires several choices that derive

from decision maker's tacit models. As we will discuss later, in the PROFSET model accountants tacit knowledge can be expressed in terms of competence in performing accounting calculations (e.g. choice of more appropriate costing method). Also the definition of absolute support threshold to extract the frequent itemset from sales transactions is the result of the decision maker's knowledge pertaining to the specific business domain that reflects their tacit models.

The integration of AIS and KMS also supports the *combination* type of knowledge conversion that generates new explicit knowledge from existing explicit knowledge and the process of model integration. Integrating generalized explicit models from different domains (e.g. accounting domain and knowledge discovery domain) provides a better understanding of the interactions between knowledge components belonging to different domains, and can create new explicit models.

Knowledge *internalization* corresponds to the adoption and use of explicit knowledge by individuals. The usage of an explicit model to solve problems is a learning experience by itself that enables the decision maker to acquire new tacit decision models. In the context of our discussion, model analysis/evaluation capabilities such as *sensitivity analysis* (or what-if analysis) that enable the decision maker to compare the effectiveness of alternative choices can facilitate the adoption of explicit model and its subsequent internalization.

Last, the *socialization* type of knowledge conversion may be considered as analogous to sharing information pertaining to decisions made by different actors included in the decision-making process (accountants and data miners), as such information reflects the tacit models followed by these actors.

3 Research Methodology

The potential benefits of integrating AIS and KMS have been evaluated by using a modified version of PROFSET model to deal with a real-world problem. Before to present the functioning of PROFSET model, we will describe the research methodology used in this chapter.

The empirical application has been conducted according to the guidelines of action-oriented approach, that means managerial problem solving through the construction of models, diagrams, plans, etc. It has been recognized that the action-oriented approach (especially the constructive approach) is a significant option for management accounting researchers to enter the field of relevant and useful problem solving [17, 18] and also satisfies the requirements of valid applied research. According to Baker [19] action research is especially suitable in the planning and implementation phases of information system applications. Action research involves, on the one hand, a thorough understanding of organizational processes in order that the intended changes can be accomplished in practice; on the other hand, it presupposes that the researcher adopts a role of a "change agent", as a person who supports the participants of the organization in their

learning processes. A successful action research study may result in an entity which fulfils the main features of the managerial construction that is intended to produce a solution to the explicit problem [18].

According to these guidelines our research can be divided into the typical phases of action-oriented studies [20] that have been conducted in the position of controller (as a “change agent”) which we assumed in the company studied in 2007:

- We have been obtained a general and comprehensive understanding of the business problem emerged, by means of periodical meetings with other managers like CIO, CFO, CMO, in the form of join interpretative forums [21, 22];
- We have been proposed a modified version of PROFSET model, as a solution idea, taking into account the specific domain knowledge and showing the theoretical connections of the solution concept and the research contribution;
- We have been implemented the solution to evaluate its practical usefulness, in terms of relevance, simplicity and easiness of operation [23] and the adequacy of the proposed approach, examining the extension of the scope of applicability.

The efficiency and usability of PROFSET model, as a tool for integrating AIS and KMS, had been demonstrated with regard to a profitability issue emerged in LUBE Industries, a company leader in the Italian kitchen furniture market. More specifically, the problem has been about identifying a subset of products which could give the maximal profit with the consideration of cross-selling effects. A fully fitted kitchen is a complex product that results from combination of different elements: clearly there exist significant cross-selling effects among items in each sales transaction. In order to identify the most profitable items, it may not be sufficient to sort items by their own profit, because by doing this we would ignore a very important aspect: some items do not generate much profit by themselves but they are the catalyst for the sales of other profitable items. The PROFSET model combines accounting calculations with a knowledge discovery technique to take into account cross-selling effects among items: by using frequent itemsets and their associated margins, it is able to select a user-defined number of products, that contributes the most to the overall profitability, maximising cross-sales potential.

3.1 The PROFSET Model

Formally the PROFSET model [24] is an optimization model, based on the calculation of the profitability per frequent set of items (PROFSET stands for PROFitability per SET). A *frequent itemset* is a set of items co-occurring frequently in sales transactions. In order to define the frequency of a generic itemset X it can be use the *support* measure, which indicates the proportion of transactions in the data set that contain all items included in X . An itemset is defined *frequent* if its support is greater than a user-specified threshold, named *minimum support*. This threshold reflects the domain knowledge of user, that determines if the number of

transactions in which the itemset X appears is such that it can be considered frequent.

A typical approach [25] to discover all frequent sets X is to use the knowledge that all subsets of a frequent set are also frequent and therefore are provided as outputs from the previous phase. For example, if the frequent itemset {beer, peanuts} of size 2 has support equal to 10 %, then also the itemset {beer} and the itemset {peanuts}—that are itemsets of size 1—appear at least in the 10 % of transactions and therefore can be defined frequent.¹ This insight simplifies the discovery of all frequent sets considerably.

The PROFSET method requires frequent itemsets as input. Indeed, the key idea of the PROFSET model is that to evaluate product profitability it is essential to look at frequent sets rather than at individual product items since the former represent frequently co-occurring product combinations in sales transactions, and implicitly allow to take into account the profits due to cross-selling effects with other products sold. In the context of our research, accounting theory and practice suggest that the definition of profit to be adopted is *contribution margin*, that is the difference between revenues and variable costs. This choice (related to the selection of direct-costing method) is supported by the consideration of the low incidence of the fixed costs within the structure of the costs, in addition to simplicity and efficiency in application.

Thus, the objective function, to be maximised, can be reformatted as follows:

$$\text{Max } Z = \sum_{X=1}^{\text{\#frequent sets}} M(X) \quad (1)$$

with the constraint:

$$\sum_{i=1}^{\text{\#ItemMax}} i \quad (2)$$

where $M(X)$ is the contribution margin of frequent itemsets X . *ItemMax* represents a user-defined number that specifies how many items are allowed to be included in the optimal set of most profitable items.

In order to determine the contribution margin of the frequent purchase combination X , it is firstly necessary to calculate the margin $m(T_j)$ generated by transaction T_j , that can be defined in formal terms as:

$$\forall T_j : m(T_j) = \sum_{i \in T_j} (P_i - C_i) * f_i \quad (3)$$

where P_i is the unit price of product i , C_i is the unit variable cost of product i and f_i is the quantity of product i purchased in T_j . Obviously the profit generated by frequent itemset X in the transaction T_j will be equal to the proportion of $m(T_j)$ that

¹ A frequent itemset of size 1 is also named frequent item.

corresponds to the items contained in X . In order to calculate the total profitability of the frequent itemset X , it would be necessary to summarise the profit generated by X in each transaction in which it occurs.

But, since all subsets of a frequent set are also frequent (by definition), each transaction T_j may contain several frequent subsets of different sizes that are overlapping each other: it poses significant problems to determine the total profitability of frequent itemsets. Indeed if a single sales transaction is allowed to contribute to the profitability of all the frequent itemsets that are contained in that transaction, it would cause duplications and the model would overestimate the total profitability of product assortment.²

There is need of a rationale to allocate the margin of transaction T_j to one or more of these different frequent subsets. To deal with this problem, the generalized version of PROFSET model employs the concept of *maximal frequent subset* of a transaction. A frequent itemset is defined *maximal* with reference to the transaction T_j , if there no exists, in the same transaction, another frequent itemset of greater size.

Using this definition, we will adopt the following rationale to allocate the margin $m(T_j)$ of a sales transaction T_j . If there is a *unique* maximal frequent itemset X , then the proportion of transaction margin $m(T_j)$ that corresponds to the items contained in this maximal subset is assigned to $M(X)$ and the process of assigning the remaining margin is repeated for $T_j \setminus X$ as if it were a separate transaction, until T_j does not contain a frequent set anymore.

However, if there are two or more maximal frequent subsets, then it will be selected the one that is likely to represent the real purchase intention for that transaction, according to the following probability distribution:

$$\Theta_{T_j}(X_{\max}) = \frac{\text{support}(X_{\max})}{\sum_{Y_{\max} \in T_j} \text{support}(Y_{\max})} \quad (4)$$

The probability distribution reflects the relative frequencies of the frequent subsets of T . The crucial idea here is that the support of the frequent subsets of T may provide a probabilistic estimation of the purchase intentions of the customer who purchased T . For example, if there are two maximal frequent itemsets in the transaction T_j , namely X {beer, peanuts} and Y {cheese, peanuts}, the former with support equal to 2 % and the latter with support equal to 1 %, then, according to the probability distribution, the frequent itemset X has a probability of $2/(2 + 1) = 2/3$ of being the real customer's purchase intention.³ Consequently, on average in two of the three times a sales transaction with these maximal subsets is

² The PROFSET model assumes that the sum of all $M(X)$ approximates the overall profitability of product assortment.

³ According to data, customers buy the maximal subset X {beer, peanuts} two times more frequently than the maximal subset Y {cheese, peanuts}, and consequently we can say that it is more likely that the real customer's purchase intention has been {beer, peanuts} instead of {cheese, peanuts}.

encountered, maximal subset $X \{ \text{beer, peanuts} \}$ will be selected and $m(\{ \text{beer, peanuts} \})$ will be allocated to $M(\{ \text{beer, peanuts} \})$. After this, T is split up as follows: $T := T \setminus \{ \text{beer, peanuts} \}$ and the process continues as explained above.

4 Empirical Study

We have restricted the analysis to new products launched on the market, because the corresponding transactions should reflect the actual trends in the customer’s purchasing behaviour. The resulting dataset was composed of 5,545 sales transactions, over the period January–October 2011. First, frequent sets were discovered from the dataset with a minimum relative support threshold of 5 % (corresponding approximately to 270 transactions). The motivation behind this choice is that an item or a combination of items should have been sold, at least, in once kitchen a day during the working year to be called frequent. From this point of view the accountants contribution is crucial because their domain knowledge indicates what level of support is to be considered as relevant.

From the analysis, 176 frequent itemsets were obtained of size ranging from 1 to 4. For the 27.6 % of the items considered, the modified version of PROFSET model selects a different product than the one with the highest own profitability ranking. For example, Table 1 shows that from the product specific point of view, “oven column H 111” is the 32th most profitable product in the assortment. So, if the maximum number of products allowed in the optimal set is less than 30, according to the product-specific profitability heuristic, “oven column H 111” will not be included. In contrast, the PROFSET method selects this product for inclusion in the optimal set. This indicates that “oven column H 111” must have considerable cross-selling opportunities with one or more products that are sold.

In the PROFSET model the impact of product replacement decisions on overall profitability can easily be evaluated by means of sensitivity analysis. This insight can help managers to quantitatively assess product assortment changes and therefore can enhance the quality of support provided by information system for strategic control. Furthermore, the replacement of items in the PROFSET model is based on dynamic reselection of products whereas for the product-specific

Table 1 Own profit and cross-selling profit (in EUR)

Product	Own profit	Cross-selling profit	Total profit	Position	Position PROFSET
Oven column H 111	13,822	178,769	192,591	32	3
Plate rack unit with vertical opening	15,925	79,131	95,056	26	8
Fridge column H 147	13,966	73,094	87,060	30	10
Wall unit with vertical opening	7,536	48,072	55,609	42	14
Top unit	13,455	13,058	26,513	34	20

profitability approach the product that replaces the exiting product will always be the one with the highest product-specific margin outside the list. If this entrant happens to have no or small cross-selling effects with the items inside the list, selecting a product with a lower product-specific profitability but higher cross-selling effects with items inside the list could be more appropriate. Obviously, the more cross-selling effects exist among products, the more impressive the profit improvement of the dynamic reselection will be, when compared to the product-specific profitability approach.

5 Conclusions, Limitations and Directions for Further Research

In this chapter, we have described the potential benefits of integrating AIS and KMS for strategic control. These benefits can be expressed in terms of better support to knowledge conversions and enhanced access to knowledge embedded in tacit models by applying knowledge discovery techniques for model externalization. More specifically, on the one hand, KMS can facilitate the discovery of trends and patterns which enhance the knowledge about the customer behaviour (i.e. frequent itemset). On the other hand, AIS can provide the economic framework for determining the interestingness of knowledge discovered, and ensure its application in the direction of real-time adaptive decision support.

We have proposed a modified version of PROFSET model as a tool for realizing this integration. Combining elements from AIS and KMS, the PROFSET model can assist decision makers in making better informed decisions: in order to evaluate the product profitability it employs tacit models of accountants, expressed in terms of competence in performing accounting calculations (identification of relevant cost categories, choice of more appropriate costing method) and specific-problem knowledge and applies knowledge discovery technique, enabling decision makers to quantitatively assess the impact of cross-selling effects among products. From this point of view the quality of support provided to decision maker is enhanced and produces benefits that cannot be realized with any one system.

A limitation can be related to the fact that just a single real-world problem is solved. But it is quite likely that a solution which works in one firm is useful in several other similar firms. Following the main ideas of pragmatism, practical usability is the major characteristic which shows the truthfulness of a managerial construction [23]. Since the specific usability of our proposed approach and theoretical connections are demonstrated, the requirements typical of the applied sciences (relevance, simplicity and easiness of operation) can be considered satisfied.

The generalization of managerial constructions may be regarded as a diffusion process of innovations occurring among practitioners, often with the help of academics. From this point of view, the potential of the solution for more general adequacy will be examined as a direction for further research. For example it

would be interesting to evaluate the effectiveness of this approach in the field of banking transactions in which it is expected that there are significant cross-selling effects among products sold to customers. Another research direction is to assess the impact of implementing the solution within the company studied. According to the classification of market tests for managerial construction proposed by Kasanen [18] our modified version of PROFSET model has been passed the weak market test: managers have been willing to apply the solution in their actual decision making. It will be interesting to evaluate if the solution will become widely adopted by company and if its systematic application will produce better performance than those which are not using it.

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Current Changes in Executive Work and How to Handle Them by Redesigning Executive Information Systems

Jörg H. Mayer

Abstract Executives in Europe have significantly expanded their role in operations—in parallel to their strategic leadership. At the same time, they need to make decisions faster than in the past. Redesigned executive information systems (EIS) should support top managers in their new roles. This article examines how corporate management is evolving, and what issues a redesigned EIS should address. Embracing a “new normal” environment, we arrive at four prescriptive statements for an EIS architecture that is more business-driven than the state of the art. This architecture differs by applying a business-to-IT approach, designed in four layers: strategy, organization, alignment, and IT support. With such a structure, it is possible to “drill-through” to information needed to executives’ more operational decisions. Furthermore the proposed architecture balances key performance indicators from five information clusters for accelerating executives’ decision making: financial accounting, management accounting, compliance management, program management, and cash flow and liquidity management.

Keywords Corporate management • Information systems analysis and design • Functional requirements • Next-generation executive information systems

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1 Introduction

Because companies operate in an increasingly dynamic environment, *corporate management* has become more complex in recent years [1]. Due to their overall responsibility, C-level managers, hereafter referred to as executives, are particularly affected by this situation. Executive information systems (EIS) help such senior managers to perform their jobs more productively and efficiently by serving as their central, hands-on, day-to-day source of information [2, 3].

Far-reaching environmental upheavals often prompt the question of whether organizations are still equipped to meet the new challenges they face. We took the 2008/2009 *economic crises* as our reference point for re-examining an issue over the last five decades [4–8]: the role of executives and the information support they receive. Points of criticism have been information overload, inadequate technology, complex IT handling, and a lack of evolution planning [9, 10].

The present moment seems favorable for redesigning EIS. First, *digital natives* increasingly populate organizations management along with digital immigrants, who learned to engage with IS and developed into EIS users over the years [11]. These new-generation managers more naturally accept EIS, but also have higher expectations about how these systems should accommodate their user preferences. Second, *technical progress* has been made in recent years, so that even senior managers should be able to operate EIS themselves. Thus, *EIS use factors* are gaining importance as EIS design broadens its scope beyond deployment to include managers' use and impact perspectives as well [12].

This article examines how corporate management is evolving, and what issues a redesigned EIS should address. Assuming that the increasingly dynamic environment represents the “new normal,” we arrive at four prescriptive statements for an EIS architecture that is more business-driven than the state of the art. In doing so, we address the following research questions:

- Taking the 2008/2009 economic crisis as a reference point, what changes are taking place in corporate management from a European viewpoint?
- What are the implications of these changes for EIS design and what concrete impact could redesigned EIS architectures have in terms of, e.g., decision-making cycle times or the quality of corporate management decisions?

After setting the foundations of the research questions and searching for promising methods and components for EIS architecture, we describe our survey. The initial survey data comes from 1999; since then, we have conducted two additional surveys. The first took place between *November 2007 and March 2008*, before the onset of the economic crisis in mid-2008. The second survey was performed between *November 2009 and March 2010*, after the downturn. Based on the findings, we discuss implications for redesigned EIS, followed by a conclusion and outlook.

2 Foundations

The common denominator of corporate management is implementing *value-creating strategies* by defining the scale and scope of companies and coordinating their activities [13]. To do so, corporate management relies on formal instruments, such as reporting “to monitor decisions throughout the organization [...] to increase the chances that a company’s objectives, including organizational performance, will be achieved” [14].

Focusing on organizational performance, the *resource-based view* (RBV) offers a concept for our work. According to Barney [15], the RBV predicts whether a certain company will outperform another and for what reasons. Every company consists of a bundle of individual resources¹ that account for how well it performs in a competitive environment. We assume that proper corporate management and its associated EIS support are such resources, especially in an increasingly dynamic environment. Taken from Marx [16] and Marx et al. [17], we compile a brief historical overview to cluster major developments in corporate management, followed by literature research on shortcomings of EIS.

The purpose of *financial accounting* is to provide the organization’s internal and external stakeholders with reliable, traceable information on the company and its legal entities. Therefore, financial accounting covers quantitative, predominantly financial information about organizational activities using standardized procedures that follow to accounting standards (e.g. IFRS [18]). Financial accounting provides stakeholders with insights in standardized forms, such as balance sheets, profit and loss statements, and cash flow statements.

Management accounting—the 1960s: Complementing financial accounting, management accounting focuses on internal requirements such as cost control, pricing, and investment calculation. It provides greater transparency by considering not only legal entities, but also management units, customers, and products. Typical management accounting output are contribution margins and results of cost or profit centers [19].

Strategic management accounting—the 1980s: Companies began using strategic management accounting to outline strategic instruments needed to implement successful strategies [20]. In doing so, the focus shifts to more qualitative, non-financial information such quality, time to market, and flexibility, as well as structured information about customers, markets, and competitors. Examples are target costing, life cycle costing, activity-based costing, and benchmarking [21]. A most prominent example is the “balanced scorecard” by Kaplan and Norton [22].

Corporate and value orientation—the 1990s: Corporate control brought a second wave of research about corporate strategies and shareholder value [23]. The most prominent voice was Rappaport [24]. In his arguments about

¹ Two assumptions underlie every resource-based analysis. First, resources are heterogeneous, so competing organizations own different bundles of resources. Second, resources are immobile, and the differences between them may not be sustainable [15].

(share-holder) value, he created new KPIs such as economic value added, return on capital employed (ROCE), and stressed the need to measure non-tangible assets. Because the approach focuses on external shareholders, communication with capital market gained importance.

Risk and compliance management—the 2000s: Fraud at the end of the last century [25] led to new legal rules (e.g. Sarbanes–Oxley Act (SOX) [26]), and risk and compliance management: The latter entails systematically scanning legal requirements and internal rules, training people accordingly, and checking that internal activities are in line with these rules. Risk management includes identifying risks, quantifying their potential damage and likelihood of occurrence, and developing strategies to avoid them [27]. Typical output of risk and compliance management are risk reports supported by frameworks like COSO [28]. The 2008/2009 economic crisis led to a renaissance in work on early indicators and their impact on financial KPIs [e.g., 29].

3 State of the Art: The Need for an EIS Redesign

Corporate management relies more and more on IS, especially EIS [30]. To a large extent, dashboards [31] and scorecards [22] fulfill the role of EIS today [32]. However, we continue to use the term “EIS,” arguing that the main purpose of dashboards/scorecards is to synthesize and present comprehensive information in a concise format. EIS, in turn, represent a more comprehensive approach with additional analytical capabilities, such as dimensional reporting (OLAP), exception reporting, simulations, trend/sensitivity analyses, and drill-downs/drill-throughs. They also support comments and communication capabilities, including e-mail and collaboration [33].

Today’s data warehouses (DWH) make data sourcing much less of an issue than it was in the 1980s/1990s [8]. EIS benefit from this development in two ways. First, DWH ensure consistent, integrated data handling and, when combined with OLAP, they improve information analysis in various dimensions, such as products, countries, and customers. New user-interfaces (“frontends”), which often apply web technology, make it easier to provide up close, more personalized access to required information. Finally, efforts are underway to make EIS results more readily available on mobile devices. Advances in both new end-user devices and user-interface software components should significantly simplify EIS handling, even for technology-averse users [34, 35].

To compile a list of current EIS requirements, we searched several databases covering the most important journals for EIS. Following our prior work [36], complemented by [37], the search string [“executive information systems” or “EIS” and (requirements or antecedents or determinates)] resulted in the following hits per database: 1,043 in Science Direct, 272 in Proquest, 95 in EBSCOhost, 3 in ACM, 254 in Wiley Inter Science, and 128 in Google Scholar.

We characterized these studies in terms of their research approach, including the number of requirements they specified and their level of granularity—in other words, whether they were abstract variables like “appropriate technology” or specific IS features like “drill down.” Our search revealed not only studies identifying individual requirements (e.g., [26]), but also approaches using lists of requirements (e.g., [38]), frameworks, and structural equation models (SEM). As a result, these publications differ significantly. Frequently cited SEM are DeLone and McLean’s [39] IS success mode and Venkatesh’s et al. [40] technology acceptance model. Most of these references provide a rigorous understanding of EIS requirements, but no direct guidance for EIS design [41].

Following Warmouth and Yen [42], we categorize our findings in terms of the scope of information the requirements cover, bearing in mind the major developments in corporate management from the preceding section, along with the EIS functions and EIS user interface. We also add a new category, information management, to cover how EIS handle relevant information flows. Table 1 shows the most-cited EIS requirements we identified.

Although it is a mature field of research, our literature review reveals that the study of EIS requirements analysis still has shortcomings. First, list approaches are practical, but most often incomplete; second, the identified requirements need to

Table 1 Overview of the most-cited EIS requirements from literature review taken from our prior work [36]

Scope of information	Functions	User interface	Information management
Compliance and controls [9]	Email integration [33]	Browse functions as navigation web provides [67]	Appropriate IS-technology:
Financial vs non-financial data [22]	Comprehensive information format [60]	Ease of use, even for senior executives: information accessibility, language, number of features etc. [66]	corporate data warehouse [8]
Internal data vs external data [3]	Multidimensional reporting (OLAP) [63]	Extensive graphics [3]	Support consistent taxonomy across businesses [58]
Additional soft, human data [59]	Drillable charts: drill down/drill through [70]		Correctness of data [69]
Task-related vs individual data [66]	Exception reporting [54]		Cost considerations [54]
Information clusters for “managing a company” [64]	Hierarchical information aggregation [64]		EIS in mobile situations [68]
	Mobile access [34]		Flexibility [70, 53]
	Print function, help function, and calendar integration [62]		Timeliness/fast response time [54]
	Simulations, trend, and sensitivity analyses [65]		

be prioritized in terms of their importance for future EIS design; and third, more recent studies are needed, since many articles are from 1990 to 2003.

One major shortcoming of the literature we found no clear picture exists regarding *EIS-specific architecture design*. Literature does offer a variety of corporate management approaches for adjusting EIS to accommodate approaches such as the balanced scorecard (Table 1). How these developments can be combined with the elements of “traditional” management reporting into a single IS architecture is a functional gap in the research on EIS development. We propose transferring elements of enterprise architecture design to redesign future EIS (Sect. 4).

4 Research Model

4.1 A Transfer from Enterprise Architecture to EIS Architecture Design

According to ANSI/IEEE 1471 [43] and ISO/IEC 42010 [44], *architectures* are defined as (a) “(t)he fundamental organization of a system, embodied in its components, their relationships to each other and to the environment,” and as (b) “the principles governing its design and evolution”. *Architecture models* can serve a variety of concrete purposes. Lyytinen [45] distinguishes three types: those that describe an individual IS; environment models, which describe interactions between multiple IS; and IS context models, which we employ, because they take a socio-technical view of IS, including its impact on an entity’s organization and operation.

Several architecture models in the IS have been developed [46]. The Architecture of Integrated Information Systems [47] includes organization, function, data, and processes. The Zachman [48] and TOGAF [49] are more generic—layered—frameworks. The first is structured using the categories of scope, enterprise model, system model, technology, and detailed representations. The latter employs the dimensions of business architecture, application architecture, data architecture, and technology architecture.

Comparing these approaches, Aier et al. [50] distilled four layers for a sound architecture design²: strategy, organization, business/IT alignment, and IT support (software and IT infrastructure). We use this structure as the starting point for both our survey (next section) and the redesigned EIS architecture developed to address the requirements it identified (section following the discussion of the survey).

² Complementary “soft factors” also play a role. They include company philosophy, culture, and politics; the leadership style specific to the company; particular patterns [52].

4.2 Survey

To specify a business-driven EIS architecture design, we conducted two cross-section *field analyses*. Since corporate management without IS has most clearly become impossible in large companies, the surveys were targeted to companies listed in the Financial Times (FT) “Europe 500” report on April 1, 2008 and October 19, 2009.

A paper-based questionnaire was sent to the corporate CEOs and CFOs for the 250 largest companies on the list. The first survey took place between November 2007 and March 2008, shortly before the onset of the economic crisis in mid-2008. The follow-up survey was conducted between November 2009 and March 2010, after the downturn, to identify findings from the crisis. Both surveys consisted of 32 questions in two categories: (a) company fundamentals and organizational context factors and (b) functional requirements of EIS (based on what the executives do).³ A similar study by Mayer [51] of German Stock Exchange (DAX) companies provided a starting basis. In 1999, 58 of the 154 executives surveyed sent back a completed questionnaire (37 %). Because just three of the 1999 respondents also participated in 2008 and 2010, the three surveys do not constitute a longitudinal study.

A total of 59 CEOs and CFOs responded in the 2008 survey (59/500: 11.8 %). In the 2010 survey, 42 questionnaires were returned (42/500: 8.4 %). Of these respondents, 30 executives returned both questionnaires (50.8 %/71.4 %). Table 2 outlines the characteristics of the population.

For both surveys, *representativeness* in terms of size and industry was proved using the Chi squared test of homogeneity based on five-point Likert scales and constant sum questions. The findings that follow were generated using univariate descriptive statistics. Frequencies were analyzed in terms of the arithmetic mean and standard deviation.

5 Results

Starting with the organizational context factors, we examined two changes due to the 2008/2009 economic crisis.

More operational responsibility at headquarters: During the period of growth from 2003 to 2007, executives devoted most of their time to “pure” strategic leadership [29]. That means they were focused on new product, new markets, etc. The more operational work how to do the business right was delegated—especially in the organization concept of a management holding—to the executives of the

³ The questions regarding functional requirements applied the proposed four design layers: strategy, organization, alignment, and IT support (software and IT infrastructure). In some cases, TOGAF guidelines helped to detail the questions within the survey.

Table 2 Sample characteristics 2008 and 2010 by size and industry

Size: market capitalization [EUR bn.] percent (%)						Response rate
≤30	30 < x ≤ 60	60 < x ≤ 90	90 < x ≤ 120	>120		n (n/500)
2008 25 (42.37 %)	18 (30.50 %)	7 (11.86 %)	5 (8.47 %)	4 (6.77 %)		59 (11.8 %)
2010 30 (71.42 %)	8 (19.04 %)	2 (4.76 %)	1 (2.38 %)	1 (2.38 %)		42 (8.40 %)
Industry: market capitalization [EUR bn.] percent (%)						Response rate
Financial services	Basic resources, construction	Automobile and industrial goods	New technologies	Chemical, pharma and health care	Retail	n (n/250)
2008 17 (28.81 %)	13 (22.03 %)	11 (18.64 %)	7 (11.86 %)	5 (8.47 %)	6 (10.1 %)	59 (11.8 %)
2010 8 (19.04 %)	7 (16.66 %)	10 (23.80 %)	7 (16.66 %)	6 (14.28 %)	4 (9.52 %)	42 (8.40 %)

divisions. According to our 2008 survey results, now 23 % of the executives said that they intervene frequently and extensively in operations—in parallel to their strategic management tasks (Fig. 1). Another 8 % characterized their involvement as very frequent and very extensive. The trend started 2008 in the financial sector due to the economic crisis, is evident in the industrial sector as well: one-third of executives said their involvement in operations is frequent and extensive, another 10 % specify they intervene very frequently and very extensively, while one-third say that they intervene occasionally/moderately in day-to-day business. All three groups therefore require more operational information such as more about stock inventory, product quality in detail, cycle times, customer complaints, etc. Based on our 2009/2010 survey findings this remains constant. Thus, we named it the “new normal”.

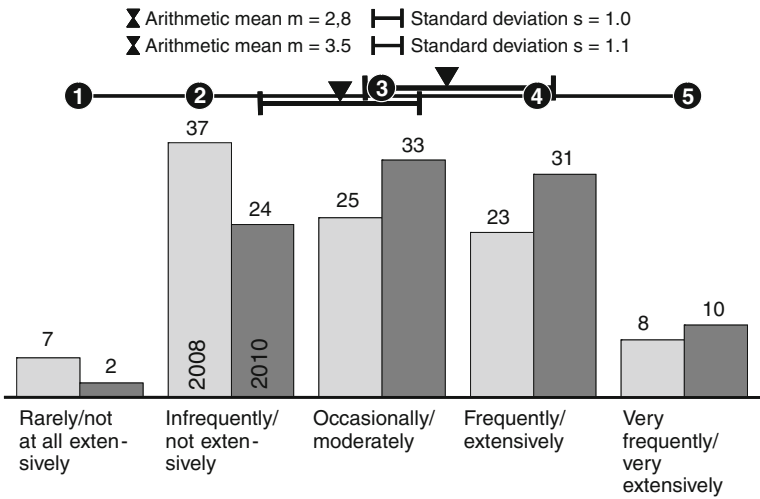


Fig. 1 Executives’ involvement in day-to-day business

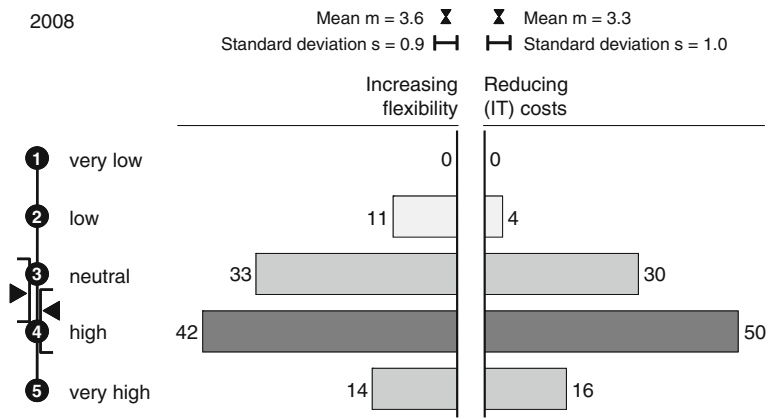


Fig. 2 Executives’ perspective on current EIS architecture objectives

Faster Decision Making and Biased EIS Objectives: A second question examined executives’ demand for flexibility. In 2008, almost 50 % answered that they are operating in an environment that is more aggressive than ever, and this situation continues in the 2010 survey. As a consequence, executives have to make decisions faster than they have in the past. Asked whether EIS architecture design should increase flexibility or lower costs, executives rate flexibility as “high” to “very high”. While executives often viewed IS as a “cost pool” in the past, the survey shows that they now consider flexibility to be of similar importance as cost control (Fig. 2).

5.1 Strategy

In the strategy layer the purpose of the EIS is set (Fig. 5). Investigating this layer, we took the “organizational imperative,” which says that an organization should be designed in light of its *vision and strategic program*, bearing in mind situational factors influencing it [30]. In terms of EIS, it should be oriented toward executives’ corporate management task.⁴ We derived executives’ main tasks from the literature review and asked survey participants three questions about how they allocate their time among these activities (Table 3).

- (1) *Internal management still remains the most important executive task, but time spent on external communication has more then tripled in the last 11 years.*
Examining the trend toward value orientation that started in the 1990s

⁴ Situations in which IS opens up new fields of business were most often exceptions [8], but they do become more and more important.

Table 3 Tasks of executives managing a company

Category	Task	1999 (%)	2008 (%)	2010 (%)	Δ 1999/ 2008 (%)	Δ 2008/ 2010 (%)
External communication versus internal management	External communication	11	36	30	+25	−6
	Internal management	89	64	70	−25	+6
Internal management in detail	Normative management	13	17	17	+4	± 0
	Strategic management	55	48	46	−7	−2
	Group services	14	10	14	−4	+4
	Cash flow and liquidity management	12	16	19	+4	+3
	Others	6	9	4	+3	−5
External communication in detail	Focused on regulatory compliance	n/a	2	2	n/a	± 0
	Biased toward regulatory compliance	n/a	0	3	n/a	+3
	Regulatory compliance vs capital market communication	n/a	59	55	n/a	−4
	Biased toward capital market communication	n/a	38	35	n/a	−3
	Focused on capital market communication	n/a	1	5	n/a	+4

(e.g., [24]), the first question was about the ratio between internal management and external communication. The executives surveyed stated that internal management still dominates their day-to-day work (2008: 64 %; 2010: 70 %, Fig. 3). However, the 2008 survey shows that time spend on external communication has more than tripled since 1999 (Table 3), the year of the reference

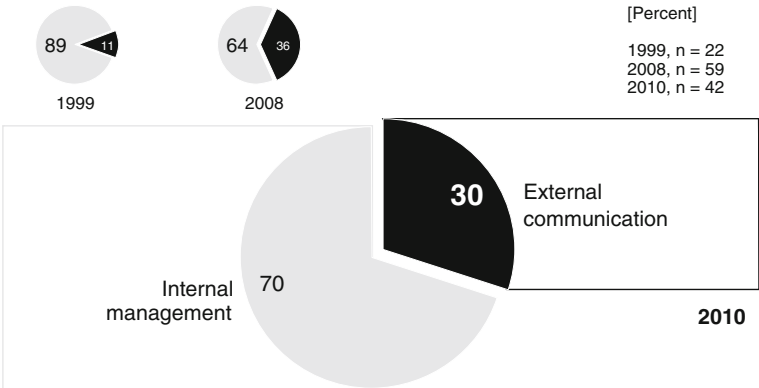


Fig. 3 Ratio of external communication vs internal management

study. The 2010 survey confirms that this 70/30 ratio between internal management and external communication has become the “new normal.”

- (2) *Executives devote about 50 % of their time spent on internal management to strategic leadership.* This allocation has not changed in the last 11 years. Among their internal management tasks, (e.g., [19]), strategic management remains the most important area for executives, accounting for about 50 % of their working time in the 2008 and in 2010 surveys (Table 3). In comparison, normative management and group services such as central procurement, sales, etc., each account for less than 15 % of internal management time. The “other” functions consist predominantly of representative activities and add up less than 10 % of executives’ time. The only area to gain importance during the 2008/2009 economic crisis was cash-flow and liquidity management (Table 3).
- (3) *Communication with capital markets has come the dominate executives’ external activities.* As a result of fraud at the end of the last century, executives now spend more time on risk and compliance management (e.g., [26]). In terms of external communication, a distinction can be made between fulfilling legal requirements and quasi-legal guidelines on the one hand (“regulatory compliance”) and (voluntary) communication with capital markets on the other (Table 3). At the beginning of the 1990s, attention was paid to performance management not only internally, but also in terms of external communication. Since that time, the number and extent of legal requirements has grown exponentially. Yet, despite the greater effort regulatory compliance now requires, more than half (55 %) of the respondents to the 2010 survey consider (voluntary) capital market communication to be just as important. A further 35 % even devote more time to this than to regulatory compliance.

5.2 Organization

In the organization layer—the second layer in our architecture design—the EIS covers reports and analyses derived from the objectives defined in the strategy layer. Reports and analyses generally vary in terms of their content and granularity (Table 1, column “scope of information,” in detail, e.g. [22, 29]).

- (1) *Defining strategy may be the more intellectually demanding task, but strategy execution and tracking is more time-consuming.* Strategic leadership can be detailed into two areas: strategy definition and strategy execution and tracking. Respondents to the survey said that they spent considerably more time on strategy execution and tracking, devoting 68 % of their time to this area in 2008 and 63 % in 2010. The 5 % climb in the time devoted to strategy definition in the last two years is likely due to the need for proactive action to improve planning content and processes, making another unanticipated crisis less likely.

Table 4 Strategy definition vs strategy execution and tracking

Category	Task	1999 (%)	2008 (%)	2010 (%)	Δ 1999/ 2008 (%)	Δ 2008/ 2010 (%)
Strategic leadership	Strategy definition	42	32	37	-10	+5
	Strategy execution and strategy tracking	58	68	63	+10	-5

- (2) *Representing about 75 % of reporting overall, standard reports have considerably more weight than a flexible reporting periphery.* Our literature review suggested that in more dynamic environments, the share of ad-hoc report should grow [51]. For this reason the next question asked about the type of executive reporting respondents needed. In the 2008 survey, three out of four executives (75 %) preferred a stable standard reporting format. Ad-hoc analyses, non-routine information, and links to upstream systems were viewed as less important for regular support and necessary in exceptional cases only (25 %). The ratio shifted only slightly in the 2010 survey to 70/30 for standard reporting/flexible periphery, disproving the importance of ad hoc reporting in more dynamic environments.
- (3) *Five information clusters provide a comprehensive view of the company.* We next researched the information clusters executives need to perform their corporate management tasks. Figure 4 shows that the executives awarded scores of 50 % or higher to five of these clusters, indicating that financial accounting, management accounting, compliance management, project management (including an overview of the most important projects), and cash and liquidity management are particularly important. As only minor changes are apparent from survey to survey, these information clusters appear to be stable and state of the art. Cash flow and liquidity management have gain in significance in the last 2 years, overtaking project management.
- (4) *Cash flow and liquidity management have become just as important as value- and profit-based targets.* Despite all the discussion of balanced scorecards,

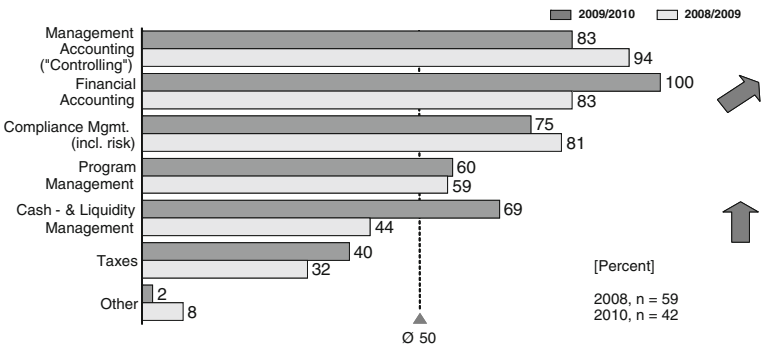


Fig. 4 Information clusters supporting executives in their task of managing a company

Table 5 Overview of most important KPIs to manage a company

Key figures (2008)	Number of mentions	Percent		Key figures (2010)	Number of mentions	Percent
EBIT—earnings before interest and taxes	20	35.7		EBIT—earnings before interest and taxes	12	29.0
EVA—economic value added	18	32.1		ROCE	11	26.0
Net sales	12	21.4		Revenue	9	21.0
ROCE—return on capital employed	11	19.6	↑	Cash flow	8	19.0
Net profit	7	12.5		ROE—return onequity	7	17.0
ROE—return on equity	7	12.5	↑	FCF—free cash flow	6	14.0
EBITDA	6	10.7	↑	EBITDA	6	14.0
EPS—earnings per share	6	10.7	↓	EBIT margin	6	14.0
FCF—free cash flow	6	10.7		EVA—economic value added	6	14.0
Market share	6	10.7		Net debt	4	10.0

when we asked which indicators executives use, result- and value-oriented KPIs such as EBIT (earnings before interest and taxes), EVA (economic value added), net sales, and ROCE (return on capital employed) emerged at the top (Table 5). However, the recent economic crisis has led to a reshuffling of cash-flow and liquidity KPIs. While free cash flow was viewed as less significant in 2008 (9th position), it is now given the same importance as indicators of profit and value (6th position, cash flow overall: 4th position).

5.3 Business/IT alignment

As we have seen, corporate management processes are undergoing increasing change. Due to its complexity and interconnectedness, IT often cannot respond quickly enough. More flexibility is a key demand from business today [29]. Our 2008 survey therefore examined the tension between two competing objectives for EIS design (Fig. 2): increasing flexibility and lowering costs. The results show that, while cost concerns dominate in practice [55], executives grant roughly equal importance to both principles. In the 2010 survey, this ratio shifted slightly towards reducing (IT) costs (arithmetic mean $m = 4.3$) instead of increasing flexibility (arithmetic mean $m = 2.5$).

A follow-up question asked about determinants of EIS change. In both survey, executives stated that EIS need more than ever to flexibly respond to changes in processes (2008: arithmetic mean = 4.0), connection to various data sources (3.6), and changes in the company's organizational structure (3.1).

5.4 IT-Support: Software and IT Infrastructure

The software layer consists of software components and data structures. We have tried to build on TOGAF Principle 5, “Common-Use Applications” [46]. In terms of the extent to which participating executives prefer standard software, the 2008 survey showed that, 46 % are indifferent to whether their EIS uses standard applications. In contrast, 21 and 23 % consider their use to be “important” or “very important”.

To specify the data structures, we turned to TOGAF Principle 10, “Data is an Asset”. Responses to our question about key projects to further develop EIS revealed that central data storage with consistent definitions of KPIs throughout the company and centralized validation guidelines are most important for executives.

The IT infrastructure level covers hardware and networks. We assumed that TOGAF Principle 4, “Business Continuity” would govern their design and asked executives what this means in terms of EIS. They replied that system outages due to hardware errors should be reduced to a minimum, and emergency plans should specify the actions to take if an outage does occur. In addition, the costs of IT infrastructure should be a major consideration when making decisions regarding architecture.

6 Implications for a EIS Architecture Design

The next step is to incorporate the implications of changes in corporate management into a proposal for a (redesigned) EIS architecture. In addition to the following prescriptive statements, our proposal includes a first “blueprint” of the complete EIS architecture, specifying its components and the links among them. Figure 5 summarizes our proposal as follows (Fig. 5).

- (1) *Strategy: Supervisory board and IR department are new stakeholders for a redesigned EIS architecture design.*

During the period from 1999 to 2010, executives have still devoted most of their time to internal management and, within this area, strategic leadership (Table 3). As a result, supporting strategic leadership should be the objective of a redesigned EIS architecture (Fig. 5). As the role of external communication has tripled in the last 11 years (Fig. 3), supporting such efforts should be a complementary objective. Finally, regulatory compliance has become more essential (Table 3). Thus, unlike its single-purpose EIS predecessors, a redesigned EIS architecture must accomplish a threefold goal. Our first prescriptive statement for redesigning EIS architecture is therefore: Support strategic leadership and communication of its results to capital markets while ensuring regulatory compliance.

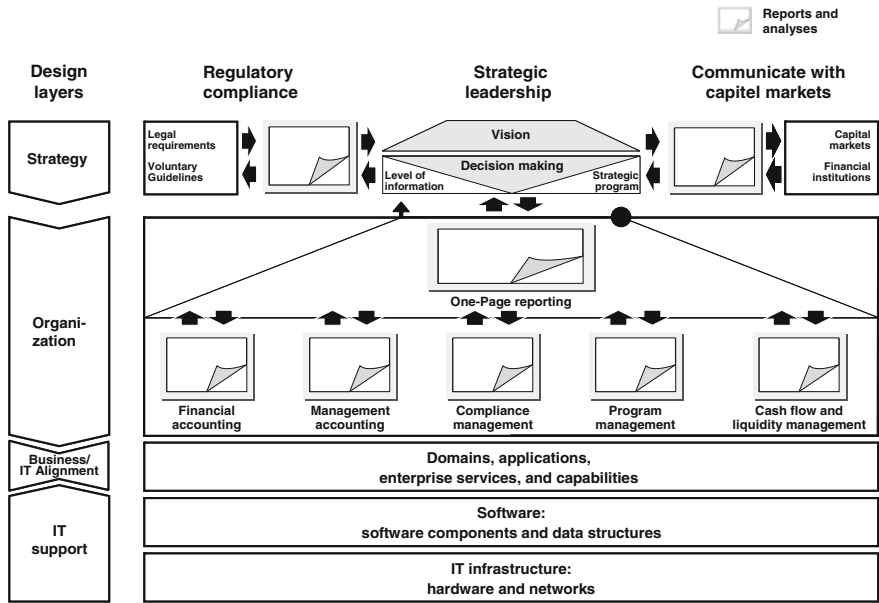


Fig. 5 Redesigned EIS architecture with four design layers

The growing importance of external communication will result in new EIS stakeholders. Besides executives, redesigned EIS will have to support investor relations (IR) to satisfy capital markets’ growing demand for information, while increasing legal requirements lead to more supervisory board control. As a “single point of truth,” EIS should be the common data and reporting platform for a company’s executive board, supervisory board, and IR department.

(2) *Organization: Cash and liquidity management, risk management as important as financial and management accounting.*

Defining strategy may be the more intellectually demanding task, but the survey results show executives devote considerably more time to executing and tracking strategy than to strategy definition (Table 4). We propose a two-step structure for reporting to “translate strategy into action” and—if deviations from planning occur—making decisions to correct the course. A one-page report should provide an overview and serve as a starting point for detailed predefined analysis, while a flexible periphery should allow ad hoc queries, access to non-routine information, and direct links to upstream systems.

The 2008/2009 economic crisis shifted executives’ attention towards cash flow and liquidity information (Table 3, Fig. 4). This new focus will lead to adjustments within standard reports. Furthermore, both surveys have shown the importance of risk management. New reports will become important that emphasize risk positions and impact on the most important (financial) KPIs. In keeping with the specification “breadth before depth” [56], we propose that

executive reports cover the most important information clusters. Following Mayer [29], we suggest five clusters: financial and management accounting, compliance and program management, and cash-flow and liquidity management. The prescriptive statement for the organization layer can be summarized as follows: A two-step reporting approach should close the strategy execution and tracking loop with one-page reporting and detailed analyses, both covering five information clusters.

(3) *Business/IT alignment: Coping with changes requires for flexible EIS architecture.*

When it comes to EIS architecture, executives now care equally about increasing flexibility and lowering (IT) costs (Fig. 2). Thus, we recommend unbundling business artefacts and IT artefacts. We propose achieving this separation with domains, (logical) applications and capabilities, and enterprise services. In accounting, [57] services represent activities such as “perform payment” or “convert currency”. Bundles of IT functionalities are labeled “capabilities” when they are not structured according to services but rather the information objects they manage or a particular corporate management process. “Applications” cover tasks such as accounts payable or receivable in the financial accounting domain and, in management accounting, value-driver trees or margin calculations. Business domains are characterized by a large number of connected applications and services, such as financial or management accounting in a dashboard (e.g., Fig. 5). Our prescriptive statement for the alignment layer is therefore: Support flexible links between corporate management processes, the relevant software components, and data structures while lowering IT costs.

Since the ability to make such modifications is often restricted in data models, transferring corresponding transactional data may require special capabilities, such as temporal data warehouses and special functionalities. Furthermore, using metadata for definitions and glossaries is beneficial [58].

IT support: IT support in our proposed EIS architecture design has two aspects (Sect. 2): software and IT infrastructure (Fig. 5).

(4a) *Software: Buy before build.*

In our two surveys, 21 and 23 % of respondents considered using standard software in EIS architecture design to be important or very important. We therefore follow TOGAF Principle 5, “Common Use Applications,” by taking a “buy before build” approach—in other words, using standard business software packages. In terms of data structures—conceptual, logical, and physical data models—we follow TOGAF’s Principle 10, “Data is an Asset,” and propose a group DWH to centrally maintain all EIS data [8]. The resulting prescriptive statement for the EIS software support layer is therefore: To ensure flexibility at acceptable cost, standard software components should be combined individually and data structures should be configured unambiguously.

(4b) *IT infrastructure: No special demands.*

The standard software components and data structures used should create any special demands on IT infrastructure. Ensure scalable, stable, and resource-efficient hardware and networks is an appropriate resulting principle for EIS IT infrastructure design.

7 Case Study and Evaluation of Research Progress

To demonstrate relevance of our redesigned EIS architecture, we applied the prescriptive statements at a chemicals company (2011 sales: USD 65 bn.; employees: 105,000). Hereafter, we describe two cases how the system addresses issues in executive decision making processes. Comparing the findings to our survey results allows us to quantify our research progress.

7.1 Three-Step Standard Reporting for Comprehensive Information Presentation

The CIO used our business/IT architecture to redesign the company's EIS to accelerate executives' decision making processes. As a first step, the CIO and his team analyzed the CSFs [59] and brought the most important financial and non-financial KPIs into a one-page format (Fig. 5). In a second step, they derived the corresponding data model. The result was a hierarchical three-step reporting approach with an increasing level of detail (see prescriptive statement # 3) allowing users to toggle through different levels of reports (Fig. 6).

The *corporate overview* shows the interplay of the three analysis levels (Fig. 6, center). The *corporate portfolio* ("A") is the most aggregated level of analysis and provides a graphical overview of financial performance with three KPIs: reward; risk; and relevance. The *corporate dashboard* ("B") is the second level of analysis. It consists of a one-page report with more detailed KPIs structured in five information clusters: financial accounting, management accounting, compliance management, program management, and cash flow and liquidity management. Finally, *corporate analyses* ("C") make deeper analysis possible with ten standard analyses and a flexible periphery for ad hoc reporting, non-routine information, and links to upstream IS.

The remaining layers of our EIS architecture design house the supporting software and data structures and the IT infrastructure with hardware and networks (Fig. 6, left, prescriptive statement # 4). A service-oriented design layer structured by business domains aligns business requirements with IT capabilities to ensure that this redesigned EIS architecture tags, synthesizes, and applies data efficiently (prescriptive statement #3).

**Corporate Overview -
starting point for standard reporting**



**Corporate Portfolio - most important KPIs
in a graphical overview**



**Corporate Dashboard - KPIs in a one-page
reporting format with five information clusters**



**Corporate Analyses - predefined drill-
through analyses and flexible periphery**

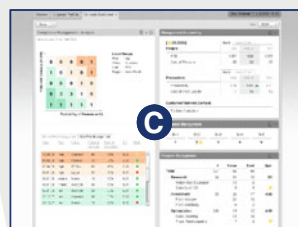


Fig. 6 Corporate navigator: a three-step standard reporting (schematic diagram with screen-shoot)

7.2 Generating Flash Reports and “Drill-Throughs” in a Service-Oriented EIS Architecture

Once the standard reporting structure was in place, the CIO redesigned the group consolidation process in order to provide more flexibility to meet changing business demands (see prescriptive statement # 4, in detail [60]). Legal consolidation requires a great deal of time. As a first management reporting, however, is a “simple summation” and would be sufficient and allow faster decision making, that rework of the IS structure became his second showcase for a more flexible EIS architecture and its impact on business value.

To do so, he derived appropriate service patterns from the consolidation process. Applications served in refining this process. In the redesigned EIS

architecture, it is easy to add a flash report as new activity in the legal consolidation process to perform this step (Fig. 7, bottom). In his instantiation, two new services—“duplicate reporting data” and “create flash report”—are added to align the process flow. Finally, a link was created to the data warehouse to allow the new “create flash report” step to be performed automatically. The data warehouse performs the process step “duplicate reporting data”. To avoid delaying the consolidation, reporting data are be duplicated for this purpose.

The capability to drill through from the financial reporting module to the enterprise resource planning system was implemented to supply executives with more operational information. For example, if the EIS provides condensed versions of the balance sheet, P&L, and cash-flow statements, drill-throughs allow direct access to the full versions, such as the complete list of accounts receivable

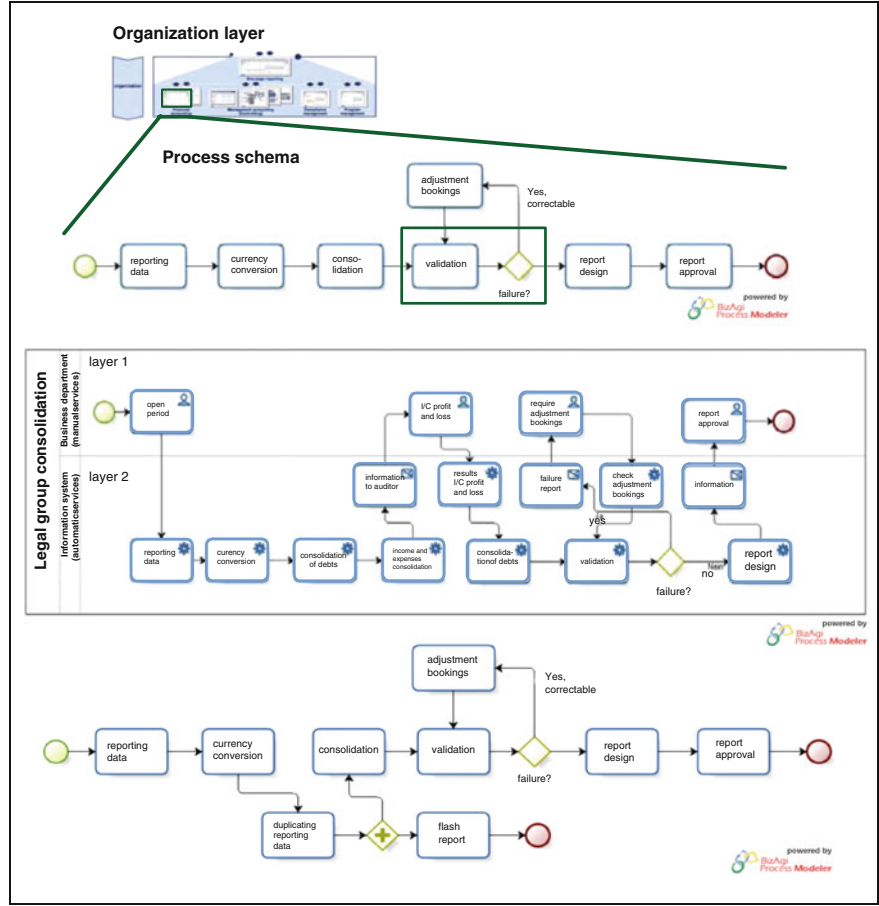


Fig. 7 Service oriented design of flash report in conjunction with legal group consolidation (taken from [57])

and payable. The re-designed EIS architecture also makes it possible to create value-driver trees or calculate different kinds of contribution margins. The program management view, in turn, offers details of strategic initiatives in terms of budget, schedule, and responsibilities. Finally, executives are able to switch from the legal structure (group and divisions) to the management structure (group, divisions, and key business units). Within this view, they can look at net sales by region or KPIs, such as margins, for the most important customers.

8 Conclusion and Outlook

The objective of this article was to examine how corporate management is evolving, and what issues a redesigned EIS should address. Based on a literature review searching for promising components and methods for an EIS architecture, we conducted two surveys and arrived at four prescriptive statements for a business-driven EIS architecture design. It differs from its predecessors by rigorously applying a *business-to-IT approach with four layers*: strategy, organization, alignment, and IT support.

A case study demonstrated how to handle current changes in executive work with a redesigned EIS architecture. A hierarchical reporting with KPIs from five information clusters accelerates their decision making (Fig. 6) and integrated even “*drill-through*” analyses (Fig. 7) which deliver information needed to executives’ more operational decisions.

For the *business side*, the EIS architecture on hand provides a multidimensional business/IT architecture to better understand interactions between business artifacts and IT artifact and it gives a first orientation of the need to select appropriate artifacts for each design layer. For the *IT side*, the approach offers an architecture that makes it possible to implement executive requirements in a consistent design from business to IT.

The first case so far makes it impossible to determine whether our prescriptive statements will meet executives’ requirements. Additional instantiations should determine the generalizability of our statements and the EIS architecture design on hand. In terms of the survey, only internal EIS stakeholders participated and the response rates for the 2008 and 2009 surveys were 59 and 42 data sets. However, the samples for other surveys are no larger, Seeley and Targett [61] work with 85 data sets, Walstrom and Wilson [62] with 43, and Nord and Nord [3] with 47, expanding the survey should be a second issue.

More in general, we expect ongoing innovations regarding the *non-functional* aspects of EIS design. Individual IS use factors such as different executive working styles, EIS use cases, and EIS access modes will more and more attack a one-size-fits-all EIS approach. New user interfaces and end-user devices, especially for mobile EIS, should simplify EIS handling, even for senior executives. A final avenue of research is the question if Web 2.0 with its interactive and collaborative features will influence a next EIS redesign. At the moment, blogging and twittering seem far away even for today’s tech-savvy executives.

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Strategic Enterprise Management in the Taps and Fittings Sector: Application of the Balanced Scorecard Methodology to Business Intelligence Systems

Roberto CandiOTTO and Silvia Gandini

Abstract Global competition is intensifying and so companies need to optimize their operational business processes. But this is no longer enough because they must also be able to react quickly on a strategic level to new developments, considering alternatives and taking the correct decisions. In the latest few years, it has become obvious that only efficient enterprise management processes ensure the consistent realization of strategy and its continuing translation into the day-to-day activities, one of the most important success factors in enterprise management today. In the light of the above said considerations, and through the analysis of the taps and fittings sector of north-eastern Piedmont, with this work we want to display: the main perspectives of analysis companies should adopt for their business performance; the main key performance indicators (KPI) for each perspective; the organization of KPI in a business intelligence (BI) system to optimize strategic management.

Keywords Business intelligence • Key performance indicator • Strategic enterprise management

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1 Introduction

Growing market competitiveness has lead modern companies to develop their information systems, in order to give managers powerful analytic tools. Since data collection has become an automated activity, the new priority is an analytical management of them. Strategy formulation hasn't meaning in fact without a correct approach to translate strategy into action and to develop feedback systems for the monitoring of business effectiveness and results, according to business goals.

This paper is structured as follows:

Performance control methodologies evolution and literature analysis;
Analysis of some representative companies, gathered in the Industrialist Association of Novara,¹ and operating in the taps and fittings sector of north-eastern Piedmont, to understand what are the most significant KPI to be used;
Organization of the determined KPI in a strategic map, useful to implement a BI system for Strategic Management.

2 Literature Analysis

In 1992 a new approach to implementing strategy has emerged, when the balanced scorecard (BSC), developed by Harvard professor, Robert Kaplan, and management consultant, David Norton, was introduced in a Harvard Business Review article [1]. The idea has spread rapidly: the BSC is a technique to translate a company's strategy into terms that can be understood, communicated and acted upon [2]. A BSC clearly defines the meaning of strategic concepts like value, quality, customer satisfaction and growth: once a scorecard that accurately describes the strategy has been developed, it serves as the organizing framework for BI systems.

The BSC should only focus on a few critical measures. Management base their decisions on only the most relevant information, therefore it is a waste of resources to gather too much information that will not be used [3–5].

Moreover, as financial measures tell only the story of the past, the BSC complements them with measures of the drivers for future performance; corporate executives can so measure how their business units create value for current and future customers, investors and other stakeholders and how they must enhance

¹ The Industrialist Association of Novara represents a selected partner for ICT4LAW, thanks to its strategic role in making the most of Piedmont territory.

internal capabilities and the investment in people, systems, and procedures necessary to improve future performance.²

3 The Taps and Fittings Sector of North–Eastern Piedmont: Perspectives of Analysis and Key Performance Indicators

Analyzed Companies: selected partner of the Industrialist Association of Novara with less than 100 employees (taps and fittings sector)

Research Methodology: direct interview

Goals:

- What are the main perspectives of analysis for business performance;
- What are the main opportunities, threats, and goals for each perspective;
- What are the most significant KPI for each perspective;
- How KPI belonging to the same perspective can be related each other;
- What are the best initiatives to be taken for a performances' improvement.

In our previous work [6], we showed how the taps and fittings sector of north–eastern Piedmont is characterized by: (1) a prevalence of family businesses; (2) quite simple control processes, based mainly on analytic accounting; (3) management information systems (MIS) inadequate in measuring both quantitative and qualitative aspects.

The second step of the analysis, actually in itinere, started with the choice of those realities more open to introduce new solutions or willing to accept changes of existing culture and applications (among the list of companies previously interviewed).³ The analysis is based on the BSC methodology, to complement

² Literature analysis has been realized on the abstracts of about 9,000 paper, in the years from 2000 to 2011, of these publications: *European Journal of Information Systems*, *Information Systems Journal*, *Information Systems Research*, *Journal of AIS*, *Journal of MIS*, *MIS Quarterly* (first 6 excellence journal and review according to the ranking of association for information systems (AIS)). The analysis has shown that: (1) BSC is quite an interesting argument in the field of Information Sciences; (2) there is a good relation between the application of the BSC methodology and business opportunities offered by BI systems; (3) many sectors have been analyzed, but not the sector we've chosen in our research.

The relation between the BSC methodology and the implementation of BI systems is also confirmed by the analysis of the first 15 available *Google Books*, related to the keywords "Balanced Scorecard and Business Intelligence systems", and on the first 20 pages of *Google Scholar*, related to the same keywords.

³ In the last year (July 2011–June 2012), we have worked with Fima Carlo Frattini S.P.A. and Rubitor S.R.L. to create, according to the main characteristics of their processes, and their informative needs, a standardized set of KPI for the considered sector. Companies interviewed in the first step of our research are showing some interest for the KPI set and availability for the testing activities of future steps.

financial measures, still used in the selected companies, with measures of the drivers of future performance. According to Kaplan and Norton theory, the determination of business goals and of their measures has to be organized around four different improvement perspectives: (1) learning and growth; (2) internal process; (3) customer; (4) financial.

3.1 Learning and Growth Perspective

It includes employee training and corporate cultural attitudes related to both individual and corporate self-improvement. In a knowledge-worker organization, people (the only repository of knowledge) are the main resource. In the current climate of rapid technological change, it is becoming necessary for knowledge workers to live in a continuous learning context. Metrics can be put into place to guide managers in focusing training funds where they can help the most. In any case, learning and growth constitute the essential foundation for success of any knowledge-worker organization. This is why companies of the sector should invest both in human resources' growth and innovation. As regards the first aspect, it's important to improve tertiary skills (great parts of production activities involve this kind of competencies) but also to create a more open organizational culture, based on a major involvement of workers in decisional processes. Regarding the second aspect, innovation is the result of well structured knowledge management strategies, based on the continuous improvement of existing ICT tools, but also on the use of less formalized solutions (i.e. blogs, questionnaires, and social networks) (Table 1).

Table 1 The learning and growth perspective: goals and KPI

HUMAN RESOURCES	
Goal 1: To ensure that employees are used in the most effective way	
Employees with tertiary qualifications % =	$\frac{\text{number of employees with tertiary qualifications}}{\text{total number of employees}}$
Suggestion implemented % =	$\frac{\text{number of suggestions implemented}}{\text{number of suggestions made}}$
Goal 2: To ensure that employees contribute to the best possible performance of the organization as a whole	
Employee satisfaction index =	$\frac{\text{number of positive feedback}_n}{\text{total number of contacts}_n}$
INNOVATION	
Goal 3: To ensure communication is really effective	
Software/hardware updating =	$\frac{\text{number of updates}_n}{\text{total number of issued updates}_n}$
Number of contacts on Facebook =	number of answers per weekly argument
Google's schedules feedback =	number of aswers per monthly schedule

Initiatives for Improvement

- Reformulate the hiring policy (check qualifications, references, motivation, etc.);
- Compare remuneration to the market to ensure that employees are compensated sufficiently;
- Create incentives for good suggestions made by employees;
- Communicate to employees how their complaints were resolved;
- Consider informal communication as important as formal to support decisional processes.

3.2 Internal Process Perspective

Metrics based on this perspective allow the managers to know how well their business is running, and whether its products and services conform to customer requirements (the mission). These metrics have to be carefully designed by those who know these processes most intimately and, for the considered sector, are strictly related with the quality and the price of metals used for production activities. This is why selected companies should improve quality inspections over the production process, controlling both input, final products, and machineries. It's also important to establish good relationships with suppliers, in order to obtain more favorable conditions for the provisioning of metals (Table 2).

Table 2 The internal process perspective: goals and KPI

Goal 1: To ensure that defect free outputs are produced	
Defect rates % =	$\frac{\text{number of defective outputs}_n}{\text{number of outputs produced}_n}$
Goal 2: To ensure rework percentages are kept to a minimum	
Rework % =	$\frac{\text{number of outputs that had to be reworked}_n}{\text{number of outputs produced}_n}$
Goal 3: To ensure resources are used most effectively	
Partial productivity ₁ =	$\frac{\text{quantity of output produced}_n}{\text{quantity of output used for materials}_n}$
Partial productivity ₂ =	$\frac{\text{quantity of output produced}_n}{\text{quantity of output used for machine hours}_n}$
Partial productivity ₃ =	$\frac{\text{quantity of output produced}_n}{\text{quantity of output used for labour}_n}$
Total factor productivity =	$\frac{\text{quantity of output produced}_n}{\text{costs of all input used}_n}$

Initiatives for Improvement

- Improve supervision controls over the production process;
- Increase quality inspection intervals and machine maintenance intervals;
- Create incentives for production workers with the lowest rework percentages;
- Negotiate with suppliers for more favorable metals' price.

3.3 Customer Perspective

Recent management philosophy has shown an increasing realization of the importance of customer focus and customer satisfaction in any business. These are leading indicators: if customers are not satisfied, they will eventually find other suppliers that will meet their needs. Poor performance from this perspective is thus a leading indicator of future decline, even though the current financial picture may look good. Selected companies are characterized by quite satisfied and consolidated groups of customers, but they need to organize and improve their communication with them. For this reason, strategic information could come from the use of social networks (i.e. Facebook), by creating a company's profile, or from the creation and diffusion of web questionnaires (i.e. Google schedules) to the company's mailing list. Moreover, opportunities can also come from the analysis of potential markets; the participation in international fairs is so important, it is necessary to understand different cultural attitudes for potential foreign clients (Table 3).

Table 3 The customer perspective: goals and KPI

POTENTIAL MARKETS	
Goal 1: To attract the highest number of buyers	
Market share =	$\frac{\text{number of customers current year}}{\text{market's number of customers current year}}$
Number of visitors in international fairs =	$\frac{\text{number of visitors of the company's stand per fair}}{\text{total number of visitors per fair}}$
Goal 2: To attract new customers at the highest possible rate	
Customer acquisition rate =	$\frac{(\text{number of customers current year} - \text{number of customers prior year})}{\text{number of customers prior year}}$
ACTUAL MARKETS	
Goal 3: To retain as many as possible of previous customers	
Customer retention rate =	$\frac{\text{number of customers who previously bought from the company}}{\text{total number of customers}}$
Goal 4: To ensure that customer is always satisfied with product and service	
Customer satisfaction index =	$\frac{\text{number of positive feedback } n}{\text{total number of contacts } n}$
Free transports % =	$\frac{\text{number of free transport per customer } n}{\text{total number of transport per customer } n}$
Goal 5: To ensure optimal profits are obtained from customers	
Net profit per customer =	$\frac{\text{profit for the year}}{\text{total number of customers}}$

Initiatives for Improvement

- Acquire a percentage of another company by means of a takeover;
- Improve the marketing campaigns and increase spending on advertising;
- Increase commission to sales staff for attracting first-time buyers;
- Improve post-sales service, by developing a constant communication with buyers;
- Communicate weaknesses identified during appraisal interviews with sales staff and develop action plans to address them;
- Increase the selling price in line with the marketing department’s market research;
- Identify possible new suppliers of metals;
- Pay attention to international consortium initiatives, it may be possible to obtain public funds for the participation at fairs.

3.4 Financial Perspective

Kaplan and Norton do not disregard the traditional need for financial data. Timely and accurate funding data will always be a priority, and managers will do whatever necessary to provide it. In fact, often there is more than enough handling and processing of financial data. KPI of this perspective are yet used by selected companies; but the point is that the current emphasis on financial indicators leads to the “unbalanced” situation with regard to other perspectives (Table 4).

Initiatives for Improvement

- Increase the selling price in line with the marketing department’s market research;
- Identify possible new suppliers of metals;
- Negotiate favorable terms regarding the takeover of the company, so that the financing will lead to an optimal capital structure, and monitor cash flow projections closely.

Table 4 The financial perspective: goals and KPI

Goal 1: To obtain optimal profitability	
Return on investments (ROI) =	$\frac{\text{operating income before interest and tax}_n}{\text{capital employed}_n}$
Residual income (RI) =	$\text{operating income before interest and tax}_n - (\text{capital employed}_n \times \text{required rate of return})$
Return on sales (ROS) =	$\frac{\text{operating income before interest and tax}_n}{\text{sales}_n}$
Warehouse rotation =	$\frac{\text{average stock}_n}{\text{sales}_n}$
Goal 2: To add value for the shareholders	
Economic value added (EVA) =	$\text{operating profit after tax} - [(\text{total assets} - \text{non current liabilities}) \times \text{post tax weighted average cost of capital}]$

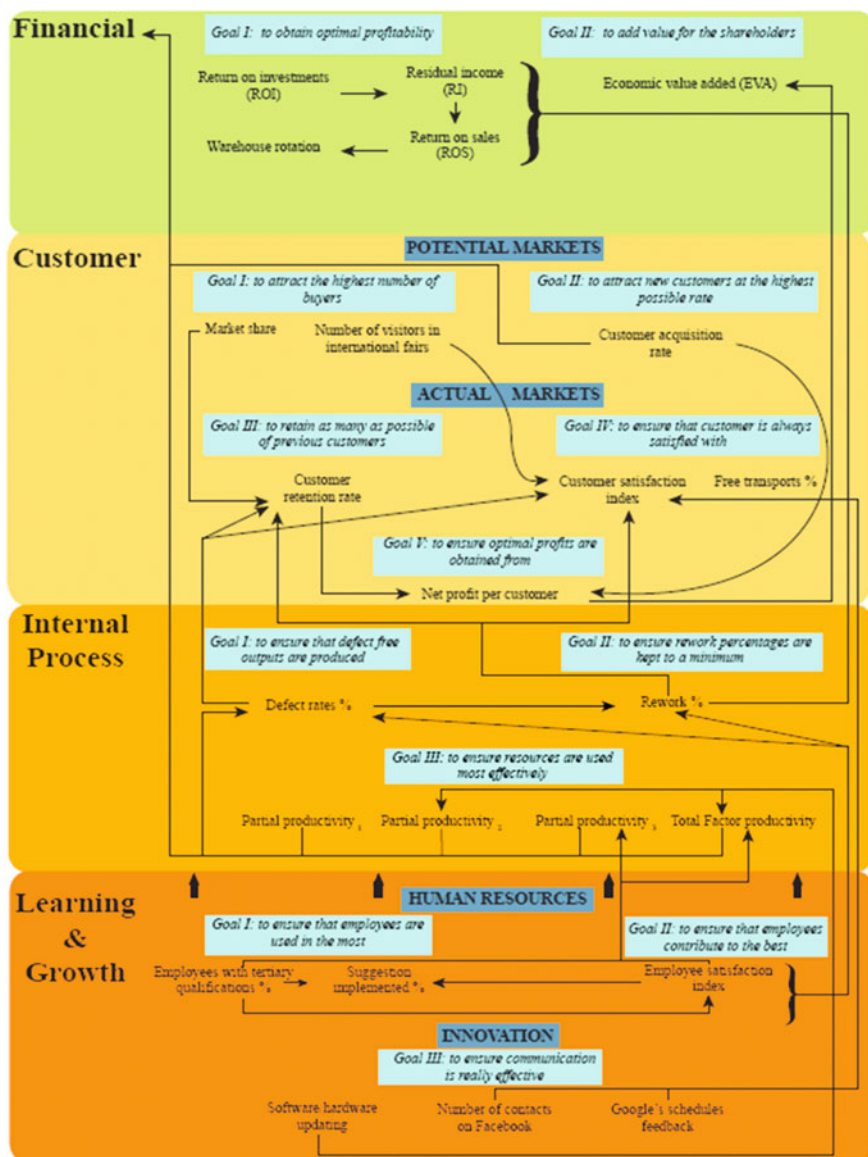


Fig. 1 KPI map for the taps and fittings sector

4 Conclusions and Future Steps

Companies that first adopted the BSC methodology, realized documents by extracting data from operational systems. A more effective strategic management process can be developed through the implementation of particular kinds of BI

systems, the so called Strategic Enterprise Management (SEM) Systems. The development of SEM systems requires a previous identification of a strategic KPI map, useful to understand how each perspective can have an impact on the others; for the considered sector, the map could be organized as shown in Fig. 1.

The future steps of our research will be based on:

- The identification of targets of performance, for each determined KPI;
- The implementation of the KPI set, through the development of SEM applications, or by improving the use of existing Management Information Systems.

After 6–8 months from the implementation time, it should be possible to evaluate the first results from the use of the new model.

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Defining Accounting Information Systems Boundaries

Iacopo Ennio Inghirami

Abstract It is clear that organizations today expect much more than simple double-entry bookkeeping from their Accounting Information System (AIS): ERPs not only support all transaction-related activities, but also provide comprehensive tools that are useful to analyze data and make decisions. However, the definition of an AIS, or what it should be, is highly dependant on the definition of accounting itself. An initial objective of this chapter is therefore to not only analyze the various kinds of accounting which are adopted in companies and any related computer-based subsystems, but also to determine if the contents of our accounting courses, particularly Management Accounting (MA) courses, are effectively aligned with the current needs of organizations. Secondly—this work will try to assess if the current definition and contents of MA are still valid or rather new perspectives suggest to broad its focus, to include new and promising fields of interest.

Keywords Management • Decision making • Financial accounting • Cost accounting • Strategic management • Strategic management accounting • Accounting information systems

1 Introduction

It is clear that organizations today expect much more than simple double-entry bookkeeping from their Accounting Information System (AIS): ERPs not only support all transaction-related activities, but also provide comprehensive tools that

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are useful to analyze data and make decisions. In fact, AISs support managers in all their tasks.

Just as managers make different kinds of decisions depending on their management level and the typology of the decision, AISs also do not consist of a single large system or even of a single computer environment. However, the definition of an AIS, or what it should be, is highly dependant on the definition of accounting itself.

Accounting Information Systems (AISs) are defined as “systems of people, data records and activities that process data and information in an organization, and they include the organization’s manual and automated processes aimed at supporting managers. Broadly speaking, AIS should support the development and execution of strategies at various management levels” [1, 2].

At a lower level AISs support business operations, while at a higher level they support more complex managerial activities. Although AISs currently support a wide range of additional managerial activities, such as Quality Management, Human Resources Management and so on, this chapter is focused on activities that are strictly accounting-related.

Academic courses usually present two main accounting systems: Financial Accounting and Management Accounting. An initial objective of this chapter is therefore to not only analyze the various kinds of accounting which are adopted in companies and any related computer-based subsystems, but also to determine if the contents of our accounting courses, particularly Management Accounting courses, are effectively aligned with the current needs of organizations.

Secondly—this work will try to assess if the current definition and contents of Management Accounting (MA) are still valid or rather new perspectives suggest to broad its focus, to include new and promising fields of interest.

In particular, the aim of this paper is to address the following research questions:

- RQ1 The contents of the various kinds of our accounting courses, particularly Management Accounting courses, are effectively aligned with the current needs of organizations?*
- RQ2 The current definition and contents of Management Accounting (MA) are still valid or rather new perspectives suggest to broad its focus, to include new and promising fields of interest?*

To answer these questions, it is necessary to discuss the meaning of AIS in depth.

2 Financial Accounting and Management Accounting

The definition of an AIS, or what it should be, highly depends on the definition of accounting itself. In fact, we have to consider two kinds of accounting: Financial Accounting and Management Accounting. While Financial Accounting is “the art

of recording, classifying, and summarizing in a significant manner and in terms of money, transactions and events which are, in part at least, of financial character, and interpreting the results thereof” [3], Management Accounting is defined as “the process of identification, measurement, accumulation, analysis, preparation, interpretation and communication of information used by management to plan, evaluate and control within an entity and to assure appropriate use of and accountability for its resources. Management accounting also comprises the preparation of financial reports for non-management groups such as shareholders, creditors, regulatory agencies and tax authorities” [4].

Financial Accounting (FA) gathers and summarizes financial data to prepare financial reports, such as a balance sheet and income statement, for the organization’s management, investors, lenders, suppliers, tax authorities, and other stakeholders. However, the primary users are external users, and financial reports must follow precise layouts and rules. FA must be accomplished in compliance with national and international principles, such as the Generally Accepted Accounting Principles (GAAP) or their equivalent in different countries. The focus of FA is on appropriately and exhaustively documenting past events, and several reports are produced every month, quarter and year.

FA theory and reference models have been defined for a long time and are not expected to change in the future. For these reasons, FA systems are quite stable and do not evolve, particularly when comparing this field with other management topics. Once the organization has introduced and established a system, FA can run for several years with very little or no changes at all, unless there is a change in external requirements such as new rules, principles or laws.

While FA is oriented towards the needs of external users, Management Accounting (MA) focuses mainly upon the needs of the internal managers of an organisation. In the literature it is possible to find several conceptual models that may prove useful in providing information to managers. These well-defined models are essentially designed for planning activities and, after the execution of those activities, to control and to report the attained results.

A non-exhaustive list of these reference models comprehends [5]:

- Cost classification;
- Job-Order Costing;
- Process Costing;
- Cost behaviour;
- Cost-Volume-Profit relationship;
- Variable costing;
- Activity-Based costing;
- Profit Planning (Budgeting);
- Capital Budgeting;
- Advanced reporting.

Although MA is essential for informed management activity, MA itself has some flaws, particularly because of its roots in Cost Accounting, as it is clear observing the above reported list. In fact, a traditional MA approach presents cost

classification and analysis, Cost-Volume-Profit models, Profit Planning (Budgeting), Capital Budgeting and advanced reporting. In the mid-1980s major complaints versus MA emerged in the literature [6].

Researchers argued that MA had not evolved over the past decades; that it was too focused on costs; and that it was not very useful for managers, especially because it was not focused on strategy and market opportunities. Not only may managers risk making inappropriate decisions based on inadequate management accounting data, but the lack of attention to clients, competition and performance could lead to an incapacity to cope with the new highly competitive environment [7] and to a poor or even a non-existing strategic approach [8, 9].

3 Towards Strategic Management Accounting

Given the different characteristics, it is possible to distinguish a new discipline, Strategic Management Accounting (SMA). Several researchers [10, 11] proposed this approach which indeed is not new. In fact, although it was initially proposed by Simmonds at the beginning of the 1980s [12], it was not taken seriously until the late 1980s.

Although there is no agreed definition of SMA in the literature [13], it is clear that MA differs from SMA in several aspects (see Table 1). It is not simply the approach, which is oriented towards strategy, but it is a radically different way of re-thinking MA [14]. As an example, Cost Accounting is completely and profoundly different from Activity-Based Costing, although they seem simply two kinds of accounting related to costs. There are noteworthy differences in terms of purpose, users, focus, rules and time span.

Wilson [15] tabulates ten key differences between MA and SMA as reported in Table 2, but he also stresses the strong link between Accounting and Marketing.

A very promising research direction for SMA is towards performance measurement: “much of the thrust of the ‘new’ management accounting has been centrally concerned with the issues of measuring and managing organizational performance” [16–18].

It is possible to find many definitions of Performance Measurement and Performance Measurement Systems in the accounting literature. While *Performance Measurement can be defined as the process of quantifying the efficiency and effectiveness of action*, a *Performance Measurement System can be defined as the set of metrics used to quantify both the efficiency and effectiveness of actions* [19, 20]. Moreover, it should be noted that these definitions focus on reference theoretical models rather than on operational models that can be effectively used in an organization [21].

Another relevant aspect that should have some impact on SMA is the progressive enlargement of firms’ boundaries: management focuses not only on internal issues, but also it should take care of relationships with customers and suppliers. These boundary-spanning forms of organizing economic activities have

Table 1 Significant differences between financial accounting, traditional management accounting and strategic management accounting

	Financial accounting (FA)	Traditional management accounting (MA)	Strategic management accounting (SMA)
Purpose	Communicate financial figures	Decision making	Strategical decision making
Primary users	External users	Internal middle managers	Internal top managers
Focus	Past oriented	Close future oriented	Far future oriented
Rules	Defined by legislation or generally accepted principles	Undefined	Undefined
Time span	Historical monthly, quarterly reports	Current to short/medium time horizons	Current to very long time horizons

Table 2 Traditional management accounting versus strategic management accounting [15]

	Traditional MA	Strategic MA
1	Historical	Prospective
2	Single entity	Relative
3	Introspective	Out-ward looking
4	Manufacturing focus	Competitive focus
5	Existing activities	Possibilities
6	Reactive	Proactive
7	Programmed	Un-programmed
8	Data oriented	Information oriented
9	Based on existing systems	Unconstrained by existing systems
10	Built on conventions	Ignores conventions

several implications for the role of management control in and in particular between firms, as *the scope of the activity of management control is enlarged and it no longer confines within the legal boundaries of the organization* [22]. For example, with respect to buyer–supplier arrangements, Otley [22] notes that *there is increased monitoring and control between organizations along the supply chain*.

4 OLTP and OLAP Systems

When discussing about Information Systems design and implementation, researchers usually make a distinction between Accounting Information Systems and Management Information System [2, 23–26], principally observing users, finalities and orientation.

If we conversely consider a technological perspective, it is possible to divide the company's Information System into two broad categories: On Line Transaction Processing System (OLTP System) and On Line Analytical Processing System

Table 3 OLTP versus OLAP systems [27]

	On line transaction processing (OLTP) system	On line analytical processing (OLAP) System
Orientation	Application oriented	Subject-oriented
Source of data	Operational data; OLTPs are the original source of the data	Consolidation data; OLAP data comes from the various OLTP databases
Time scale	Stores current data	Stores history data for analysis
Indexing	Optimizes update performance by minimizing the number of indexes	Optimizes ad-hoc queries by including lots of indexes
Database design	Highly normalized with many tables	Typically de-normalized with fewer tables; use of star and/or snowflake schemas
Redundancy	Non-redundancy	Redundancy
Queries	Relatively standardized and simple queries returning relatively few records	Often complex queries involving aggregations
Organization	Data stored revolves around business functions	Data stored revolves around information topics
Stored values	Stores typically coded data	Centralized in data warehouse or in a collection of subject-oriented data marts
Homogeneity	Scattered among different databases or DBMS and using different value coding schemes	Centralized in data warehouse or in a collection of subject-oriented data marts
Data model	Entity-relationship	Multi-dimensional

(OLAP System) [27]. The former supports the processing of all business transactions or, in other words, it supports the basic activities of a company. The latter, OLAP System, is capable of performing complex elaborations by rearranging data and it is designed to support higher level activities, i.e., the managers' tasks.

Although complementary and closely linked, the two systems are profoundly different from many points of view (see Table 3). Furthermore, these two systems rely on two radically differing IT approaches. In OLTP systems, the core technology are Relational Databases, while OLAP systems are implemented by means of Multidimensional Databases.

OLTP market is currently quite settled and stable. A long development path began in the Seventies with Material Requirements Planning (MRP) systems, which then evolved into Manufacturing Resources Planning (MRPII) systems. Finally the demand for increased functionality led to the current Enterprise Resource Planning (ERP) systems.

More recently, a new approach has deeply changed ERP systems, aligning them to new requests. ERP II take in consideration the new firm's boundaries, and they are able to manage e-business and collaboration in the supply chain and in customer relationships [28]. In particular, the following modules have been added: Supply Chain Management (SCM); Customer Relationship Management (CRM);

Supplier Relationship Management (SRM); and Product Lifecycle Management (PLM) (see Table 4).

Ex post, one can conclude that ERP systems emerge from the availability of two approaches: (1) sound accounting theory that analyzes the entire organization, divides activities in several business processes and carefully describes all that has to be done; (2) robust IT technology, in particular Relational Databases technology which is capable of adequately and quickly executing all required tasks.

Also OLAP Systems had a long development path (see Table 5): more than 30 years ago, the so-called Decision Support Systems (DSS) emerged [30]. DSS were based on models and data: by means of models, DSS were able to transform data into useful information and knowledge. Moreover, they were supposed to support decision-making processes at all management levels.

DSSs were followed by Expert Systems (ESs), which were based on Artificial Intelligence paradigms. ESs should behave like human experts and help managers in their tasks. The approach was interesting, but the technology was still too premature and therefore these systems turned out to be too simplistic.

ES lasted a few years and then slowly faded away. For a short time period, it seemed that top managers would adopt Executive Information Systems (EISs), i.e., systems capable of summarizing and reporting the current situation of an organization. Even in this case, the proposed systems were too simplistic and never had a widespread distribution.

In any case, the experience gathered from DSSs, EISs and Ess—and the availability of new information systems technologies, such as OLAP systems, as we will see below—generated a brand new class of applications: Business Intelligence (BI) systems. In fact, BIs are systems capable of transforming data into useful information and knowledge in support of decision-making processes [1] in order to pursue the objectives that enterprises must attain in order to sustain their competitive advantage [33]. Moreover, some BI modules, Data Mining Modules in particular, rely on Artificial Intelligence paradigms for some aspects.

We have to underline another big shift in technology: while DSS were based on relational databases, BI adopted a completely new paradigm that relies on Data warehouses and Multidimensional Databases [34].

Just like what happened in ERP, the availability of two theories favoured the birth of new systems. In fact, the merging of Business Intelligence related information systems technologies with theoretical approaches referable to SMA, Business Measurement models in particular, led to a new class of computer-based systems: *Business Performance Management* (BPM). BPM is defined as “a set of integrated, closed-loop management and analytic processes, supported by technologies, that address financial and operational activities. BPM helps businesses define strategic goals and measure and manage performance against those goals” [10].

In other words, *BPM can be described as a series of business processes and applications designed to optimize both the development and the execution of business strategy* [32, 35]. Synonyms for *Business Performance Management*

Table 4 MRP, MRP II, ERP and ERP II as defined by the APICS dictionary (our revision of [29, 28])

Material requirements planning (MRP)	A set of techniques that uses bill of material data, inventory data, and the master production schedule to calculate requirements for materials. It makes recommendations to release replenishment orders for material. In addition—because it is time phased—it makes recommendations to rescheduled open orders when due dates and need dates are not in phase
Manufacturing resources planning (MRP II)	A method for the effective planning of all resources of a manufacturing company. Ideally, it addresses operational planning in units, financial planning in dollars or euro, and has a simulation capability to answer “what if” questions. It is made up of a variety of functions, each linked together: business planning, sales and operations planning, production planning, master production scheduling, material requirements planning (MRP), capacity requirements planning (CRP), and the execution support systems for capacity and material. Output from these systems is integrated with financial reports such as the business plan, purchase commitment report, shipping budget, and inventory projection. MRP II is a direct outgrowth and extension of a closed-loop MRP
Enterprise resource planning (ERP)	ERP is a complete enterprise-wide software solution. The ERP system consists of software support modules such as: Marketing and sales, field service, product design and development, production and inventory control, procurement, distribution, industrial facilities management, process design and development, manufacturing, quality, human resources, finance and accounting, and information services. Integration between modules is stressed without duplicating information. ERP systems are an out growth of MRP II systems
Extended enterprise resource planning (eERP or ERP II)	A business strategy and a set of industry-domain-specific applications that build customer and shareholder value by enabling and optimizing enterprise and inter-enterprise, collaborative-operational and financial processes. ERP II is essentially componentized ERP, e-business and collaboration in the supply chain. In particular, the following modules have been added: supply chain management (SCM); customer relationship management (CRM); supplier relationship management (SRM); product lifecycle management (PLM). ERP II systems are an out growth of ERP systems

include *Corporate Performance Management* and *Enterprise Performance Management*.

Gartner Institute, one of the major Information Technology analyst institutions, states [36]: “Corporate Performance Management (CPM) supports both cost

Table 5 Historic development of decision support systems

Decision Support System (DSS)	A computer-based information system that supports business or organizational decision-making activities. DSSs serve the management, operations, and planning levels of an organization and help to make decisions, which may be rapidly changing and not easily specified in advance. A DSS is a support for management decision makers who are dealing with semistructured problems [30] [31]
Expert systems (ES)	A computer-based system that emulates the decision-making ability of a human expert. ES are designed to solve complex problems by reasoning about knowledge, like an expert, and not by following the procedure of a developer as is the case in conventional programming.
Executive information system (EIS)	A computer-based system intended to facilitate and support the information and decision-making needs of senior executives by providing easy access to both internal and external information relevant to meeting the strategic goals of the organization. It serves the information needs of top executives [1]
Business intelligence (BI)	A broad category of applications and technologies for gathering, storing, analyzing, and providing access to data to help enterprise users make better business decisions [1]
Corporate performance management (CPM)	A series of business processes and applications designed to optimize both the development and the execution of business strategy. Also called business performance management (BPM) [32]

source our revision of [32]

optimization and growth initiatives. CPM is a suitable fit for nearly all organizations, and should be a priority initiative for CFOs to enable the finance function to deliver short- and long-term strategic benefits to the business”.

5 Accounting Information Systems, a Summarizing Schema

We have presented two separate but closely connected aspects of an AIS: on one side, the theoretical approach, which is primarily linked to the development of the accounting discipline; on the other side, the concurrent development of Information Systems. We need to present a summarizing outline that merges and integrates these two aspects.

On the theoretical side, we need to implement at least three different accounting approaches: (1) Financial Accounting; (2) Management Accounting; and (3) Strategic Management Accounting. As we have seen, each approach has different users, methodologies and focus, and management needs to take advantage of all of them in order to properly address current challenges facing firms.

On the Information System side, it is necessary to implement two separated but strictly connected environments: (1) On Line Transaction Processing systems, that manage every issue related to transactions; and (2) On Line Analytical Processing systems, that are more powerful and flexible in supporting those analytical processes that are useful for management to extract data and transform it into information.

As stated above, when considering different users, finalities, reference models and focus, Accounting Information Systems (AISs) should be divided into three sub-systems: Financial Accounting Sub-systems (FAs), Management Accounting Sub-systems (MAs) and Strategic Management Accounting Sub-systems (SMAs).

These three sub-systems are closely related, and mutually exchange data and information. In any case, their separations are quite fuzzy and in several cases they can not be clearly recognized. For instance, it is impossible to define exactly where FA ends and MA begins, and several tables and data contained in databases can be related to both systems. It is even more complex to precisely define MA and SMA due to the fact that data and models are nearly identical, and the only difference is the strategic approach.

Considering the above mentioned Information Systems classification and their characteristics, we can state that FA and SMA should be implemented by using different environments, OLTP and OLAP respectively, and MA should be implemented by using both OLTP and/or OLAP systems, depending on the characteristics of each specific model.

FA requirements are completely fulfilled by OLTP systems. The software applications of this category, the so-called Enterprise Resource Planning (ERP) systems, may be configured to support primary business processes such as the Customer Order and Account Management process, the Procurement and Cash Disbursements process, and the Production process. The ERP usually also manages other duties that are not strictly related to FA. In fact, software producers have added appropriate modules to their ERP for Manufacturing Management, Quality Management, Human Resources Management, Properties Management, and so on. In any case, the common element of every ERP module is the transactional approach. Every modification of the databases is "triggered" by a fact, and these facts generate appropriate transactions that update the data contained in databases. As a result, since the prevalent reference model is based on the transactional approach and calculations and reporting are not very demanding, an OLTP environment can, and must, be adopted.

MA is usually implemented by using OLTP or OLAP systems, depending on the characteristics and the technological complexity of each specific model. If the reference model is closely linked to transactional data, then an OLTP environment should be selected. Cost Accounting, as an example, heavily relies on invoices, which are typically handled by transaction systems. Conversely, if the model requires multidimensional analyses, heavy computations or complex reporting, it is better to use an OLAP environment. This is the case, for example, with budgeting processes, where it is important to analyze data from multiple points of

Table 6 FA, MA and SMA, a summarizing table

	Financial accounting (FA)	Traditional management Accounting (MA)	Strategic management Accounting (SMA)
Data	Internal	Internal	External and internal
Technology	OLTP	OLAP or OLTP	OLAP
Primary users	External users	Internal middle managers	Internal top managers

view (client, product, market, etc.,) and then summarize it and produce differing and complex reports.

SMA finds its appropriate environment in OLAP systems. These systems are flexible and powerful, and are conceived to allow managers to “play” with data. Since the time of DSSs, the principal orientation of OLAP systems is towards the empowerment of management capabilities (Table 6).

**6 Accounting Theory and AIS Development:
A Conjoint Analysis**

Although it is possible to find in the literature, as we have seen, papers related to Management Accounting (MA), or papers focusing on the implementation of MA, the so-called Management Accounting Systems (MAS),—which are a particular kind of AISs—it is not possible to find papers that jointly discuss both topics. In this sense, a future research topic could be to determine if new insights may emerge from analyzing MA and MAS together. Hence, we may try to determine if some new implication may emerge from treating together MA and MAS.

In fact, some interesting considerations could be done if we compare the accounting perspective with the Information Systems perspective, making a distinction between Transaction Systems (TS) (Fig. 1) and Analytical Systems (AS) (Fig. 2).

In TS the main difference between ERP stage and ERP II stage is the different management approach: while in ERPs the focus is on internal measures and processes, in ERP IIs firms not only consider internal aspects, but also all the relations with external entities, customers and suppliers, thus implementing the Extended Enterprise paradigm [28].

Looking at AS evolution, we may observe that the accounting perspective of the last stage (CPM) is based on an enrichment of MA contents—a strategic approach in particular—but also on a new organizational perspective. As we will see in our empirical case, organizations not only desire to implement CPM models, but they also want to build sound, effective and well-documented organizational procedures.

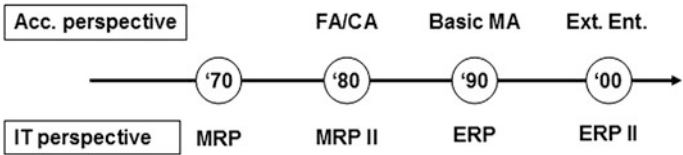


Fig. 1 Evolution of transaction systems (TS)

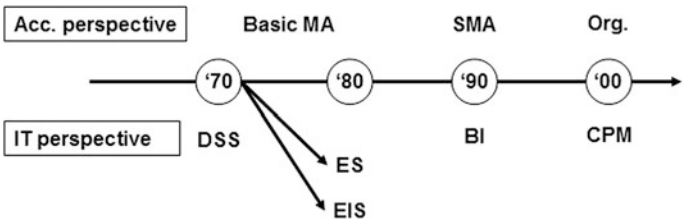


Fig. 2 Evolution of analytical systems (AS)

7 The Tagetik Case

As previously noted, while FA and MA have been relatively stable over a long time period, SMA is continuously evolving, following both market trends and theoretical models. Managers have to face new challenges related to the increased speed of commerce, world wide competition, and constantly changing markets. There is a strong and increasing need for flexible and powerful tools to fully understand business. Researchers propose new models that replace obsolete reference model; in other cases, new models are added to existing ones to better address new requests [37].

As an example, Kaplan and Norton [38] proposed a new model, the Balanced Scorecard (BSC), that added non-monetary point of views to the already existing monetary figures in order to better understand business performance.

While new models and approaches are proposed by researchers, the real adoption of such tools largely depends on the markets. It is beyond the goals of this chapter to investigate the way in which new theories originate and spread, but we are interested in understanding how these new emerging techniques are included in AISs.

In order to answer this final research question (Which are the drivers that guide the development of an AIS and keep it aligned with new management needs?) we decided to study a real case: a software house that produces one of the main CPM suites.

The methodology used is the case study research approach, following the methods recommended in the literature. The decision to analyze a single case study [39] may be useful for giving a detailed outline of the grounds and distinctive features of the development and subsequent implementation of CPM

systems. It appears superfluous to point out that, as the case is specific, the results of the research carried out are of a specific nature and may be interpreted differently.

The case study approach [40] is, however, interesting since it may offer the option of constructing theories and generalizations based on the study of a single operational case [41–43].

In the case examined the benefits of such an approach can be seen in the ability to illustrate the factors that drove the company to develop its system and the consequences within the planning and control function.

The research carried out features aspects of a qualitative nature: the data examined are based on interviews, the company's economic and financial documentation made available to the public on the company's website and on internal reporting documents. The interviews were conducted with the CFO manager, the Chief Development Officer and those responsible for management control. The interview as opposed to the questionnaire approach offers greater flexibility even if the results were characterized by a certain degree of subjectivity due to the difficulties of interpreting the answers. However, this was useful for understanding the competitive context in which the company operates and the particular features of the sector to which it belongs.

Gartner states that CPM market is dominated by three ERP mega-vendors: Oracle, SAP and IBM [36]. All three of them leverage their strong position as market leaders in the ERP software arena. To be the provider of ERP system has a relevant influence on CPM tools acquisition, because:

1. the data that feeds CPM systems primarily comes from ERP or legacy systems;
2. the principal and indispensable software to manage a company is the ERP software, not the CPM;
3. ERP vendors try to offer CPM systems as a simple add-on to their previously installed ERP systems;
4. it is perceived as safer to continue the relationship with the ERP vendor rather to start with a new software provider.

In any case, there is an Italian firm, Tagetik, which is positioned relatively close to the above mentioned market leaders.

With a global presence in twenty countries and over four hundreds customers worldwide, Tagetik is a successful Italian software producer. Tagetik's global headquarters are located in Lucca, and with subsidiaries in several countries it is capable of offering its CPM solutions worldwide. In this field, Tagetik proposes its flagship CPM suite, *Tagetik 4.0*. This solution supports management with a wide range of processes such as Planning and Budgeting, analysis of their current business situation (we may call it Business Intelligence), allocation of the company's resources, verification of financial results and production of information that is valuable for effectively managing business performance.

Tagetik first started as a management consultancy more than 25 years ago (at that time its name was "Gruppo Servizi"—Services Group) and since then has developed its flagship product on the basis of many years of hands-on consulting

experience. In fact, as it recognized the demand for a specific software solution of its customers, it started developing and selling its own software. Today, *Tagetik* 4.0 supports all aspects of performance management—including planning (strategic plans, budgets, forecasts), control (closing, consolidation, reporting, profitability analysis, cost allocation) and financial information (consolidated statements, disclosure, financial reporting).

We had several interviews with Marco Pierallini, Chief Development Officer of Tagetik, in order to understand some aspects of the software development process. The following is a summary of what emerged in those talks.

In most cases, the first step in introducing a computer-based system in an organization is to select an appropriate system capable of handling Financial Accounting. While it is possible to find several solutions and even more software providers, currently the most widespread choice is to adopt one of the many available ERPs. Once this basic requirement is fulfilled—thereby implementing a working AIS—the next step is to find a way to support one of the many other managers' needs in the accounting area. Which one comes first strictly depends on management priorities. At this point, organizations face a big dilemma: is it preferable to stay with the current ERP provider, which inevitably proposes to add a new module to the existing ERP, or is it better to begin a new software selection process and, after selecting the best solution, implement a completely new software system in addition to the existing one? This question arouses also when a company wonders which CPM solution it has to buy. The option to continue with the previous ERP provider seems to be very attractive.

Tagetik recognizes various levels of releases of a product: (1) a product completely new (*Tagetik*, as an example); (2) an innovative version of the product, radically different from previous versions (*Tagetik* 1.0, 2.0, etc.); (3) an upgrade of a version of the product (*Tagetik* 4.0, 4.1, etc.); (4) a patch (*Tagetik* 4.1a, 4.1b, etc.).

Tagetik develops a new product to fulfil the needs of a customer that hasn't found any other product suitable to its needs. There are two drivers that lead to a new version of the software. The first is primarily technological, such as the availability of a new version of the middle-software from one of Tagetik's technological partners (as an example, Microsoft releases a new version of software with new characteristics to take advantage of) or it emerges a new standard to adhere to (HTML5, Web 2.0).

The second driver is to fulfil a specific functional request that derives from a need presented by a customer or requested by the Marketing department in order to align the product itself to new functionalities added from competitors to their products. For this reason Tagetik continuously observes its competitors, carefully comparing the features, the strengths and the weaknesses of its products with those of its competitors.

As stated before, there are strong relationships with several technological partners, and the more relevant one is with Microsoft. Partners usually show Tagetik all the forthcoming innovations in which it may be interested, eventually providing "Alpha" and "Beta" versions to experiment with.

We believed that new theories were fostered by software producers which were supposed to include new reference models in their products. Our hypothesis was that software houses were the link between researchers and organizations.

Apart from very large software companies (namely Microsoft, SAP, Oracle and few others) that invest directly in academic research or have their own research centres, medium-size software producers tend to wait until a new theory is well established and widespread. The introduction of new reference models is therefore mediated from the market.

This behaviour is probably due to the fact that software developers want to be certain about the acceptance of new models and, secondly, they don't want to be involved in consultancies and/or excessively theoretical courses. It's worth considering that a theory like BSC—which was proposed in 1996 by eminent researchers and that quickly convinced all the academic world—took almost 15 years to be adopted by firms.

8 Conclusions

At this point, summarizing our researches in the literature and the experience gathered in our case study, we may try to provide some concluding responses to our Research Questions.

- Q1 The contents of the various kinds of our accounting courses, particularly Management Accounting courses, are effectively aligned with the current needs of organizations?
- A1 Accounting is not a single, monolithic subject. It is possible to identify at least three different kinds of Accounting: Financial Accounting (FA), Traditional Management Accounting (MA) and Strategic Management Accounting (SMA). Thus, observing current organization implementation of AIS, some adjustments are needed in our accounting courses. In particular, if we desire a coverage more aligned with firm's requests, FA courses should include several topics traditionally belonging to MA. As an example, cost accounting and budgeting. On the other side, MA courses not only have to be more exhaustive about those topics, but have to cover strategy-related advanced topics.
- Q2 The current definition and contents of Management Accounting (MA) are still valid or rather new perspectives suggest to broad its focus, to include new and promising fields of interest?
- A2 While FA as well as MA theory and practice are relatively stable and well established, SMA is currently evolving, both in terms of theoretical reference models and practical applications. We believe that MA courses should at least add a strategic approach to traditional one, but it is also necessary to enrich courses with more recent approaches, such as Balanced Scorecard, Activity-Based Cost Management (ABCM) and even Activity-

Based Management (ABM). Moreover, Strategic Management Accounting has to focus attention upon parties external to the organization [13, 14, 17].

Final observation: although it is possible to find in the literature, as we have seen, chapters related to Management Accounting (MA), or chapters focusing on the implementation of MA, the so-called Management Accounting Systems (MAS),—which are a particular kind of AISs—it is not possible to find chapters that jointly discuss both topics. In this sense, we believe that a future and promising research field could be to determine if new insights may emerge from analyzing MA and MAS together.

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Break-Up Analysis: A Method to Regain Trust in Business Transactions

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Abstract The financial crisis resulted in a loss of trust; not only within the investment or banking sector, but in general between creditors and debtors, because many organizations faced insolvency. Such a financial situation can even result in a company's bankruptcy. Therefore it is necessary to get a realistic understanding of the solvency or the possible insolvency of a company. The support of a decision on a debtor's creditability is not yet sufficiently provided by the most prominent method (Altman's Z''-score). The paper presents a procedure called Break-Up Analysis (BUA). It helps to decide on the solvency of a company. The comparison of the BUA to Altman's Z''-score shows an improvement of the identification of solvent and insolvent companies by 22 %. The BUA enables herewith to regain trust in business transaction by not identifying only the insolvent companies but the solvent ones as well.

Keywords Solvency • Bankruptcy • Bankruptcy prediction model • Financial data analysis • Break-Up analysis • Z-score

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1 Introduction

“The financial crisis is a devastating loss of trust” [1] (US President Obama, January 9th, 2009). Trust is defined as “a reasonable belief that trusted persons will tell the truth and keep their promises” [2]. The business term credit refers to trust and belief. Since the financial crisis has evolved, banks, people, companies, and even countries are not able to follow their commitments. Creditors have been left with outstanding receivables—promises to pay money back have not been kept. But trust is essential for financial markets and commercial relations in general [3] as it is the fundament for economic developments. Without credits in business environments, accruing different points in time of revenues and expenditures cannot be managed. To rebuild trust, it is necessary to enable a judgement based on company’s information in order to assess the solvency or insolvency of a company to fulfil liabilities. This paper proposes a method to assess company’s solvency, as well as insolvency, based on available financial data, supporting stakeholders in their decisions and therefore it contributes to regain trust in business transactions

Altman’s Z-score is a known method to assess company’s insolvency [4–8] but there are critiques against it [9–17]. He created a grey zone in which a direct evaluation of the results is not possible. Reference [13] criticized the grey area, because in his study 59 % of the firms fell in it. A broad area of discretion remains where a decision on the company’s financial health is not supported. Altman himself stated: “Hence, it is desirable to establish a guideline for classifying firms in the grey area” [18].

The Z-Score focusses on the identification of bankrupt companies but “the percentage of firms classified as potential failures that do not fail (type II errors) in the population calls the operational utility of the model into question” [5]. It is of importance to identify non-bankrupt companies in order to regain trust and enable economic development.

To overcome Altman’s drawbacks and in order to regain trust in business transactions by focussing on recognizing the non-bankrupt ones, too, this paper proposes a method called Break-Up Analysis (BUA). The BUA improves Altman by classifying the companies that fall in his grey zone and furthermore focuses not solely on recognizing bankruptcy but additionally recognizing financially healthy companies. The BUA recognizes 70 % of the non-bankrupt companies (Altman’s Z’-score recognizes 37 %) and it furthermore recognizes 90 % of the bankrupt ones (Altman’s Z’-score recognizes 100 %). The overall improvement compared to Altman’s recognition is 22 %. The paper contributes to the research field of (in)solvency analysis by improvements in analytical ability to judge on a company’s solvency and herewith to the field of Accounting Information Systems (AIS). AIS are seen as socio technical systems consisting of a whole of organized data, human resources, techniques, and procedures [19]. They can be understood as part of a more general information systems and serve as information provider for decisions [20]. The decision which is supported is the critical judgement of the solvency of a company.

The remainder of the paper is as follows. Among Sect. 2, a detailed literature review of insolvency prediction is done, which enables a distinct view on the state of the art. Section 3 contains a description of the proposed method, called BUA. Section 4 starts with the description of the sample selection and applies the BUA on it. Among Sect. 5 the results of the BUA are discussed in contrast to Altman's Z''-score. Concluding, further research steps are shown among our research model.

2 State of the Art

Since most of the approaches focus on insolvency prediction as the literature recognizes the higher cost related to wrong classification of bankrupt companies [4] we regarded as well the field of bankruptcy prediction for a state of the art. The era of bankruptcy prediction models started with the development of [21] univariate analysis and has continued to evolve since then. He initially used ratio analysis as a predictive tool for bankruptcy. Beaver tried "to provide an empirical verification of the usefulness (i.e., the predictive ability) of accounting data (i.e. financial statements)" [21]. His univariate analysis set the stage for other methodologies developed afterwards including Altman's approach in 1968.

The fundamental assumption, on which most of the failure prediction methods are based, is that firms can generally be split into groups: non-bankrupt and bankrupt ones. The category of methods that use such an assumption includes discriminant analysis, e.g. univariate discriminant analysis [21, 22] or multivariate discriminant analysis [18], logit analysis [15, 23], probit analysis [24, 25], and linear probability models [26].

According to [27, 28], discriminant analysis method is the most frequently used in business failure studies. Second frequently used are artificial intelligence (AI) methods such as artificial neural networks (ANN) (for example: [29, 30]) and third frequently is the logit analysis [27]. Studies using probit analysis are less frequent, because more computational effort is required [28]. Basically, "artificial neural networks -like their biological counterpart-, are designed to emulate the human pattern recognition function by the parallel processing of multiple inputs, and can capture the causal relationships between the independent and dependent variables in any given data set" [31].

Reference [32, 33] divide bankruptcy prediction models into two main streams: statistical models and AI models. The first main stream includes for example discriminant analysis [18, 21, 22], logit analysis [15, 23] and probit analysis [24, 25]. The second one, according to [34] comprises a spectrum of methods that range from ANN [29, 30], genetic algorithms (GA) and support vector machines (SVM) [33, 35] to classification and regression trees (CART) [36]. Nevertheless, a comprehensive review of methods, as suggested by Mukhopadhyay et al. [37] is provided by Aziz and Dar [38]. This latter review classified models into statistical, artificial intelligent expert system (AIES), and, although relatively uncommon, theoretical models. "Unlike the statistical and AIES models, which focus on firms' symptoms

of failure, the theoretic models determine causes of bankruptcy” [38]. This approach designs bankruptcy prediction models on some theoretic arguments [39].

The identified theories by Aziz and Dar [38] behind the models are: the Balance Sheet Decomposition measure (BSDM) or Entropy Theory [40–42], the Gambler’s Ruin theory [43, 44], the Cash Management theory [45, 46], and the Credit Risk theory [47–49].¹

According to [27], some bankruptcy prediction models are more focused than other. For instance, some models are developed in favour of the prediction of bank’s failures. Others are specifically for the prediction of manufacturing entities’ failures, or simply for non-US companies’ failures.

The proposed model is, in an initial step and due to this, narrowly focused on small and medium-sized Italian enterprises (SMEs). We consider the role played by SMEs in the economy of many countries fundamental. According to the annual report on European SMEs 2010/2011 in 2010, more than 20.8 million enterprises were active in the non-financial business sector within the European Union, of which 99.8 % were SMEs. About 67 % of the employment in the non-financial business economy is provided by SMEs.

Existing studies are specifically focused on the prediction of SMEs’ failures by applying multivariate discriminant analysis [50, 51] or logit analysis [52, 53]. Reference [54] used multivariate discriminant analysis and neural network approaches.

As stated earlier, Altman improved the technique of Beaver by using multi-discriminate analysis. In his original Z-score, he combined a number of financial statement and market value measures. He used five variables that reflected liquidity, profitability, leverage, solvency, and activity [18]. These variables were chosen based on their contribution as univariate predictors, popularity amongst practitioners, and correlation with other variables [55]. A subsequent version of the Z-score was introduced as Z’’ (Z double prime) or generic corporate model [52, 56–61]. It is reduced to four variables, not five as in the original model: the Sales/Total Assets variable was removed and the coefficients re-estimated.

Although, some more sophisticated models have reported better results (see for example the review of bankruptcy prediction studies written by Bellovary et al. [27]) the Altman model is still popular today, because of its efficiency [7], simplicity and clarity. It continues to have significant value for financial statement users [4, 5].

3 Model Development of the Break-Up Analysis Approach

According to [62], the going concern concept is a choice from among alternative models. The allegation that the going concern is necessary to accounting has not been proven, yet. A liquidating concern can be useful, too, “to measure the true income and position” [62].

¹ Authors cited by Li et al. [38].

The winding-up value of a company is determined by assessing the value of company assets that can be sold quickly (less the liabilities). Bankruptcy courts usually require a liquidation value in order to determine the bottom-line worth of a company, which can be paid to creditors upon dissolution [63]. Broadly speaking, debt-holders want assurances that the minimum amount of net assets will be greater than their contracted sum [64].

Asset values in a business liquidation calculation are not based on market values, but such accounting assumptions might be necessary, sometimes.

The introduced BUA is a stronger approach. The hypothesis is that the company must break-up and all business is closed; assets must be sold, no new business is allowed and all the existing contracts cannot be fulfilled anymore. Reference [65] applied these break-up concepts in order to assess the company solidity. He cut off the book value of intangibles of investments, of own shares, of receivables from shareholders, and the total value of dividends to be paid from the net worth. He called this margin *capitale netto di garanzia*. He used this approach as a solidity margin in the much broader research field of financial statements analysis. We adopted this break-up approach to enable a prediction of the companies' solvency. Of course, the interest of the potential creditors is important as well as the knowledge about potential risks of failing to fulfil liabilities. Therefore, our approach recognizes potential insolvent companies, too.

According to [21] "failure is defined as the inability of a firm to pay its financial obligations as they mature" [21]. By applying a break-up approach, the distinction between current and non-current liabilities makes no sense, because all liabilities become current. Applying a break-up logic means to check, whether the company is able to extinguish all liabilities at any time. It also checks the capacity of corporate assets to repay the contracted liabilities completely and permanently after they are sold.

As suggested by [64, 66, 67] we used the balance sheet as it provides information on the liquidation value of a company. Through the balance sheet, debt-holders may check, whether the companies' net assets are less than the face value of their debt.

Based on the hypothesis that a company will be solvent, if it is able to repay all off his debt, we reviewed the assets side of the balance sheet and integrated the liability side by so called memo accounts. Some assets could be removed by deletion in the balance sheet (BS). Other cut off items had to be found in the notes (N) or in the register of the shareholder's resolutions (RSR). Specifically, we cut off the elements (Table 1) from the balance sheet and added the amount of total risks to total liabilities (taken from the memo accounts).

The resulting value is the so called Break-up Value (BUV). The BUV will be negative, if the company is not able to fulfil its obligation. The BUV will be positive, if the company is solvent.

Table 1 Cut off elements/items and corresponding statements

Cut off elements	Statement
Total receivables from shareholders	BS
Total intangible fixed assets	BS
Tangible fixed assets: assets in process of formation and advances	BS
Financial fixed assets: equity investments in subsidiary, associated and parent companies	BS
Financial fixed assets: receivables due from subsidiary, associated and parent companies	BS
Financial fixed assets :receivables due from third parties :other related companies: financial assets advances	N
Financial fixed assets :own shares	BS
Current assets inventories: contract work in progress; advances	BS
Current assets receivables: due from subsidiary, associated and parent companies	BS
Current assets receivables :total advances on tax payments	BS
Current assets receivables: receivables due from third parties: receivables due from other related companies, services advances.	N
Current assets receivables invoices to be issued	N
Current financial assets: investments in subsidiary, associated and in parent companies.	BS
Current financial assets: own shares	BS
Prepayments and amortizable discount on issued debt	BS, N
Dividends to be paid	RSR

4 Application of the Break-Up Analysis Approach

4.1 Sample Selection

According to [68], it is important that the definition of “failure” adopted in any bankruptcy prediction study must be clearly stated. This study reviewed 93 small and medium-sized Italian enterprises (SMEs), as defined in EU law recommendation 2003/361 that filed a bankruptcy petition (*Fallimento*) or started a pre-bankruptcy agreement (*Concordato preventivo*) under the Italian Bankruptcy law (Royal Decree n. 267 of 16 March 1942.) during the period 2011–2012. Bankruptcy data came from <http://www.fallcoweb.it>.² For each company, we reviewed the recent three financial statements available before default. Financial statements were directly downloaded from the official business register of the Italian Chambers of Commerce. 37 companies that used the condensed form of the Italian annual report within the meaning of Article 2435-bis of the Italian Civil Code and 26 companies with no financial data available for years 2011, 2010 and 2009 were then removed from the list. The remaining population of 30 companies was further classified by EU NACE codes (21 C-Manufacturing; 8 G-Wholesale and retail

² Fallcoweb.it (Portale dei Fallimenti) it's a free to access daily updated database where data from forty-four Italian Bankruptcy Courts is stored.

trade, repair of motor vehicles and motorcycles; 1 Accommodation and food service activities; NACE Rev.2). Companies were also grouped by number of employees [expressed in annual work units (AWU)] and by annual turnover (determined by calculating the income of the enterprise received during the year in relation to its sales and services after any rebates have been paid out) and by total assets to be able to decide whether the companies are micro, small (9 companies), or medium (21 companies)-sized.

Due to industrial classification and size differences, this group is not completely homogeneous. A careful selection of non-bankrupt firms was attempted. The non-bankrupt group consists of a sample of 30 SMEs (according to the EU staff headcount criterion) chosen from the database *Bilanci di Marca Awards*.³ This award brought an improved financial reporting in Italy. This allows an assessing on how entities have complied with the requirements of Generally Accepted Accounting Principles (GAAP) besides common financial data analysis. Neither one of the chosen control firms filed a bankruptcy petition nor started a pre-bankruptcy agreement by 31 May 2012, nor reported for two or more consecutive years a negative EBIT value. The latter criterion is to ensure a financially not to highly distressed state of the company according to [69]. The border for an exclusion from the sample could have been reduced to one or more consecutive years of operational losses. But in challenging times like the financial crises that border might be too strict.

According to [70], the control sample should include only non-distressed firms because “a continuing firm is not necessarily financially healthy. [...]. Consequently, not all the members of the samples of non-failed firms...are necessarily distinct from the respective failed sets” [70].

At that time, we could not know, whether the obtained control sample included “non-failed firms but financially distressed firms” [71]. Nevertheless, we believe that in order to do such an analysis the next financial statements (2012–2013) are needed. This analysis is done as part of the next step of our research. The initial sample is composed of 60 SMEs with 30 in each group.

4.2 Results

According to the described elements the BUW became calculated. The following Tables 2 and 3 contain the results for the BUW calculation for all companies.

³ Bilanci di Marca is a project developed by three Italian University (University of Macerata, University of Ancona, University of Urbino), coordinated by Professor Antonella Paolini, Professor Stefano Marasca and Professor Massimo Ciambotti. Each year a team composed by academics reviews the financial statements of a sample of companies-operating in the Marche Region (Italy)—grouped by turnover and employees. More information on Bilanci di Marca Awards can be found on www.bilancidimarca.it.

Table 2 Calculated BUVs for non-bankrupt companies

ID	Year n – 2	Year n – 1	Year n
1	21,173,390	20,892,244	20,442,994
2	8,171,086	7,632,777	8,082,987
3	1,462,825	1,417,402	1,687,996
4	7,812,789	6,997,548	6,498,576
5	8,708,545	8,565,779	4,352,291
6	1,882,642	2,333,362	2,123,172
7	2,184,510	2,114,198	1,980,929
8	13,351,587	13,340,530	13,607,528
9	–9,253,066	–8,960,190	–9,775,825
10	7,578,010	6,984,263	10,911,050
11	1,381,981	896,189	1,123,865
12	6,534,631	8,003,343	9,594,439
13	–5,038,003	–4,701,259	–3,355,488
14	564,315	204,367	–281,345
15	2,629,633	3,067,143	3,219,721
16	415,700	1,049,196	–5,384,657
17	6,111,316	3,237,151	2,521,457
18	10,344,650	10,746,849	10,427,550
19	7,127,034	5,689,850	5,221,952
20	647,793	839,914	1,217,069
21	3,893,023	6,184,767	7,577,361
22	6,731,354	6,948,991	7,042,846
23	8,398,071	8,609,610	7,888,778
24	–1,911,793	–2,135,445	–6,199,733
25	5,070,296	7,673,882	6,932,649
26	4,203,007	4,856,825	5,505,069
27	100,744	1,651,584	3,306,425
28	1,632,173	2,994,798	4,272,239
29	145,561	–164,718	–163,119
30	–441,522	–449,539	4,939,043

There are three companies, number 9, 13 and 24, which have not been regarded as solvent in any of the years. In comparison to the later in detail presented results of Altman's Z''-score number 9 is regarded as bankrupt, number 13 and 24 are regarded as grey zone elements. But there is no general pattern neither concerning the size of the company nor concerning the industry. The Table 4 shows the quality of the classification of all balance sheets of the 60 companies.

According to the hypotheses test for 30 non-bankrupt (bankrupt) companies a significance level of 0.950 will be ensured, if the prediction is between the boundaries of 22.4 and 37.6. This leads to 23 and 37 as integer borders. The prediction of 27 non-bankrupt companies (H0: the BUV predicts the non-bankrupt

Table 3 Calculated BUVs for bankrupt companies

ID	Year n – 2	Year n – 1	Year n
31	370,686	–362,470	–16,164,085
32	4,730,552	4,777,352	–1,349,383
33	4,631,644	3,004,534	–3,855,605
34	25,589,153	25,841,771	–117,497,328
35	2,659,956	1,030,848	–1,574,377
36	285,791	–12,388	–4,951,284
37	–546,478	–5,511,440	–8,291,268
38	2,310,266	1,162,866	–1,698,327
39	4,420,096	4,729,588	–5,781,650
40	273,700	–6,211,046	–7,055,586
41	–1,094,361	–946,260	–2,054,526
42	–4,126,222	–8,087,052	–9,569,432
43	2,104,776	–1,229,297	–14,594,467
44	–6,012,236	–7,850,873	–14,322,130
45	–8,707,705	–12,170,604	–12,361,728
46	–2,534,670	–4,172,080	–5,658,164
47	10,513,597	4,295,192	3,404,534
48	–2,069,098	–2,241,326	–4,313,667
49	–21,148,556	–26,827,828	–30,506,688
50	458,632	–4,098,308	–6,250,253
51	–70,717,724	–54,600,646	–37,236,244
52	15,638,996	11,399,111	7,744,772
53	–1,320,922	796,358	–433,757
54	7,925,775	7,070,328	4,988,890
55	697,723	–654,349	–2,661,711
56	9,284,017	8,980,197	–8,714,391
57	–22,879,649	–29,243,821	–16,359,048
58	466,615	217,716	–1,644,106
59	–4,658,010	–5,439,794	–7,220,573
60	147,887	–3,114,822	–9,292,465

Table 4 BUV classification

	Non-bankrupt	Bankrupt
Predicted as non-bankrupt	75	33
Predicted as bankrupt	15	57

companies) is therefore significant. If we reverse the goal of prediction (H0: the BUV predicts the bankrupt companies), the BUV prediction will be significant as well with 33 predicted ones. We regarded the last year of the prediction as the year of the bankruptcy was the closest possible and therefore the sample contained the strongest signal for their solvency (insolvency) resulting in a control sample with high quality.

5 Discussion

In order to enable a comparison of the methods we applied both approaches, the Z''-score and the BUA on the same data. Tables 5 and 6 show the results of the prediction of the BUV and Z''-score for 60 anonymised companies. Companies 1–30 are the non-bankrupt and 31–60 are the bankrupt ones. For each, the last three available financial statements are used for a prediction. Year n corresponds to the last available financial statement. The overall amount of classified statements is 180.

Table 5 BUV and Z''-score predictions over the investigation period of three years for non-bankrupt companies

ID	Year n – 2		Year n – 1		Year n	
	BUV	Z''-score	BUV	Z''-score	BUV	Z''-score
1	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Grey zone
2	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt
3	Non-bankrupt	Grey zone	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt
4	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt
5	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Grey zone
6	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone
7	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt
8	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt
9	Bankrupt	Grey zone	Bankrupt	Grey zone	Bankrupt	Grey zone
10	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt
11	Non-bankrupt	Bankrupt	Non-bankrupt	Bankrupt	Non-bankrupt	Bankrupt
12	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt
13	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt
14	Non-bankrupt	Bankrupt	Non-bankrupt	Bankrupt	Bankrupt	Bankrupt
15	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone
16	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Bankrupt	Non-bankrupt
17	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Grey zone
18	Non-bankrupt	Grey zone	Non-bankrupt	Non-bankrupt	Non-bankrupt	Grey zone
19	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone
20	Non-bankrupt	Bankrupt	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone
21	Non-bankrupt	Grey zone	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt
22	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone
23	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone
24	Bankrupt	Grey zone	Bankrupt	Grey zone	Bankrupt	Grey zone
25	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone
26	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt
27	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt
28	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone
29	Non-bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt
30	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Non-bankrupt	Non-bankrupt

Table 6 BUW and Z''-score predictions over the investigation period of three years for bankrupt companies

ID	Year n – 2		Year n – 1		Year n	
	BUW	Z''-score	BUW	Z''-score	BUW	Z''-score
31	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Bankrupt	Bankrupt
32	Non-bankrupt	Bankrupt	Non-bankrupt	Bankrupt	Bankrupt	Bankrupt
33	Non-bankrupt	Bankrupt	Non-bankrupt	Grey zone	Bankrupt	Bankrupt
34	Non-bankrupt	Grey zone	Non-bankrupt	Bankrupt	Bankrupt	Bankrupt
35	Non-bankrupt	Grey zone	Bankrupt	Bankrupt	Bankrupt	Bankrupt
36	Bankrupt	Grey zone	Bankrupt	Bankrupt	Bankrupt	Bankrupt
37	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone	Bankrupt	Bankrupt
38	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone	Bankrupt	Bankrupt
39	Non-bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt
40	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt
41	Bankrupt	Grey zone	Bankrupt	Bankrupt	Bankrupt	Bankrupt
42	Non-bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt
43	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt
44	Bankrupt	Grey zone	Bankrupt	Bankrupt	Bankrupt	Bankrupt
45	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt
46	Non-bankrupt	Grey zone	Non-bankrupt	Bankrupt	Non-bankrupt	Bankrupt
47	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt
48	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt
49	Non-bankrupt	Grey zone	Bankrupt	Bankrupt	Bankrupt	Bankrupt
50	Bankrupt	Grey zone	Bankrupt	Grey zone	Bankrupt	Bankrupt
51	Non-bankrupt	Grey zone	Non-bankrupt	Grey zone	Non-bankrupt	Bankrupt
52	Bankrupt	Bankrupt	Non-bankrupt	Bankrupt	Bankrupt	Bankrupt
53	Non-bankrupt	Bankrupt	Non-bankrupt	Bankrupt	Non-bankrupt	Bankrupt
54	Non-bankrupt	Grey zone	Bankrupt	Bankrupt	Bankrupt	Bankrupt
55	Non-bankrupt	Bankrupt	Non-bankrupt	Bankrupt	Bankrupt	Bankrupt
56	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt
57	Non-bankrupt	Bankrupt	Non-bankrupt	Bankrupt	Bankrupt	Bankrupt
58	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt
59	Non-bankrupt	Non-bankrupt	Bankrupt	Grey zone	Bankrupt	Bankrupt
60	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Non-bankrupt	Grey zone

Overall, the BUW predicted 132 financial statements correct and 48 wrong. Compared to that the Z''-score predicted 108 correct and 72 wrong. Therefore, the BUW improved the prediction by the Z''-score by 22 %. An evaluation of the results concerning the error rates per year is given in the following Table 7.

As we intend to predict the non-bankrupt ones ($H0_{BUA}$: predict the non-bankrupt companies) the error types are defined as follows: type one error (marked light grey) regards non-bankrupt companies, which have been predicted as bankrupt ones; type two error (marked dark grey) regards bankrupt companies being predicted as non-bankrupt ones. With that $H0_{BUA}$ the type one error for all years of

Table 7 Type I and type II error (H0: BUA/Z''-score predict the non-bankrupt companies)

			Non-bankrupt	Bankrupt
Year n – 2	Predicted as non-bankrupt	BUV	26	18
		Z''	12	14
	Predicted as bankrupt	BUV	4	12
		Z''	18	16
Year n – 1	Predicted as non-bankrupt	BUV	25	12
		Z''	15	7
	Predicted as bankrupt	BUV	5	18
		Z''	15	23
Year n	Predicted as non-bankrupt	BUV	24	3
		Z''	12	0
	Predicted as bankrupt	BUV	6	27
		Z''	18	30

the BUV (Z''-score) is 17 (57) percent. The type two error for all years of the BUV (Z''-score) is 37 (23) percent. As Altman intended to recognize the bankrupt ones it is necessary to compare furthermore his predictive power (H0_{Altman}: predict the bankrupt ones) to our one by reversing the error rates. In that case the type one error of the BUA (Z''-score) is 37 (23) percent and the type two error of the BUA (Z''-score) is 17 (57) percent. By comparing the total error (total type one and total type two errors) rates the overall prediction becomes measureable. The BUA (Z''-score) has a rate of 27 (40) percent. If we regard both predictions each under its own H0 (BUA predicting the non-bankrupt ones, Z''-score predicting the bankrupt ones), the error type one (two) of the BUV will be 30 (35) percent less than the Z''-score one.

A deeper analysis of that error for the last available financial statement unveils that the Z''-score recognizes 30 and the BUV 27 of the 30 bankrupt ones. The Z''-score defined 54 financial statements as belonging to the grey zone. Within the grey zone the BUV classified 36 financial statements right (6 as bankrupt, which have been bankrupt, and 30 as non-bankrupt, which are non-bankrupt) and 18 wrong. As we intended to predict solvent companies it is obvious that we fulfilled our aim and we further maintained a high quality of the prediction of the bankrupt ones (just 10 % less than Z''-score).

As we furthermore want to improve the prediction among the grey zone we analysed the results in that area separately as well. The Z''-score regarded 54 balance sheets as grey zone ones. Overall, 30 different companies have been regarded as grey (16 non-bankrupt and 14 bankrupt). Over the years, the Z''-score classified 40, 33 %, and in the last year n even 47 % of the non-bankrupt companies as grey zone ones. That high rate confirms [13] argument especially for non-bankrupt companies that the Z''-score is not appropriate. The following table shows the results in total and for each year separately, too (Table 8).

The table shows that the BUA recognizes 36 balance sheets (corresponding to 66 %) of the grey zone right. In year n-2 (n-1, n) among 24 (16, 14) grey zone

Table 8 BUA prediction for financial statements falling into Z'' -score's grey zone

		Non-bankrupt	Bankrupt
Total	Predicted as non-bankrupt	30	12
(54 <i>financial statements</i>)	Predicted as bankrupt	6	6
Year $n - 2$	Predicted as non-bankrupt	10	8
(24 <i>companies</i>)	Predicted as bankrupt	2	4
Year $n - 1$	Predicted as non-bankrupt	8	4
(16 <i>companies</i>)	Predicted as bankrupt	2	2
Year n	Predicted as non-bankrupt	12	0
(14 <i>companies</i>)	Predicted as bankrupt	2	0

companies 14 (10, 12) companies have been correctly classified by the BUA. The grey zone corresponds to a range where the Z'' -score has no predictive power therefore the second goal of our research is reached.

Three further ways, which measure the accuracy of prediction, are sensitivity (the rate of the correct positive), specificity (the rate of the correct negative) and the F^B -measure, which combines both measures, which naturally have a trade-off. The higher all of them are the better the prediction model is. Those measures are used to compare both methods in their predictive power. We regarded each under its own hypothesis to enable a fair comparison.

With an $H0_{BUA}$: predict the non-bankrupt companies the BUA has a sensitivity of 0.83 and a specificity of 0.63 and an F^B -measure of 0.72. With an $H0_{Altmann}$: predict the bankrupt ones the Z'' -score provided a sensitivity of 0.76, a specificity of 0.43 and an F^B -measure of 0.55. The advantage of the BUA is reflected in the improved prediction power as well.

6 Conclusions

The proposed research focused on an improvement of the state of the art of bankruptcy prediction (the Z'' -score) in its initially defined drawbacks. The BUA outperforms the Z'' -score, which is a contribution to the field of solvency or bankruptcy prediction.

We acknowledge that the BUA could still be improved by identifying other relevant balance sheet items and by using qualitative variables [72–74] as predictors. There is still room for an improvement concerning the bankrupt ones and that is one of the future areas of research.

The method itself can be used in the daily business of investors and banks to decide on the assignment of credits or investment decisions. For the calculation of the BUA, only a few elements of the balance sheet are needed. It is also beneficial that within the current on-going changes of the financial reporting supply chain by

the introduction of the eXtensible Business Reporting Language (XBRL), data will be increasingly available and more easy to use.⁴

Further research should analyse the applicability of the method on an international level and other company sizes to show its generalizability. In order to support a decision making an additional future field of research is an increase in automation to be able to calculate early indicators in favour of a timely adequate decision support.

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⁴ XBRL is a standard for electronic reporting, which gets more and more mandated across the world in the recent years (<http://xbrlplanet.org/index.php>).

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Hierarchical and Relational Database Accounting Systems: Critical Aspects and Trade-Offs

Carlo Caserio, Luciano Marchi and Gabriele Pulcini

Abstract Although the transition from hierarchical to relational databases marked a crucial turning point in the development of accounting systems, the concept of hierarchy has not entirely been abandoned. The aim of this research is to highlight the critical aspects and trade-offs between the hierarchical and relational structures of a database accounting system (DAS). First, we address the relationships between database accounting structure and accounting data coding: hierarchical coding, as distinct from sequential encoding schemes, may have different implications on the selectivity/accuracy/efficiency of the DAS. Next, we investigate the impact that both structure and data encoding schemes have on select queries and update queries: hierarchical models allow for higher efficiency in performing select queries, but higher rigidity in executing update queries; conversely, relational models allow for higher flexibility of update queries, but higher complexity in performing select queries. Finally, we offer suggestions for managing the trade-offs between both types of DAS.

Keywords Hierarchical • Relational • Database accounting systems • Selectivity • Flexibility

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1 Literature Analysis

In the late 1970 s, Codd [1–3] laid down the principles of the relational model and a set of 12 rules to be followed to achieve a relational system.

That list has now been reduced to two main rules, stating that a system is relational if (1) it represents data in the form of two-dimensional tables such as the database table and (2) it supports the relational algebra functions of restrict, project, and join [4]. With the relational model, problems like the ordering dependence, the indexing dependence and the access path dependence were resolved [1]. After a few years, the entity/relationship (E/R) model of Chen allowed an improvement in the design and implementation of the relational model [5]. The mathematical rigor and simplicity of these systems have long been their strong points.

The attention paid by companies to relational models has increased over time, and, as a consequence, many firms have moved from the hierarchical to the relational model. Today, the attention paid to the relational model design is still high, and both theoretical and practical contributions [6] in this sense are aimed at explaining the role of data modeling for an effective relational database design.

Over the last forty years, several database systems have come onto the market, using hierarchical, network, relational, object-oriented, and XML data models. As the performance of relational database systems has continuously improved, the companies have felt the need to convert non-relational database systems into the relational, or to add a relational component to non-relational models.

Such change is due to the following advantages recognized in a relational accounting database system [7]:

- Higher flexibility and data independence;
- The user-oriented languages Data Definition Language (DDL) and Data Manipulation Language (DML);
- Their relatively simple maintenance and physical storage conditions.

Other advantages of the relational model include minimizing data redundancy, preventing anomalies of data entry and facilitating both the updating and the deleting process [8].

However, there are many drawbacks with accounting database systems. First, the semantics of relational databases are often hidden within the complex set of relationships and such semantics cannot be extracted without users' help. Also, relations stored in the database must be in normal form, in order to prevent the representation of multiple or set attributes. According to some authors, the problem of redundancy is not completely eliminated through the use of the relational model. In fact, in order to establish a relationship between two entities, common attributes must be included in both entities and thus in both related tables [9]. Indeed, a critical shortcoming of the relational database model is that there is little guidance on how to discover important information (e.g. functional dependencies) in the real world. Thus, there is no guarantee of normal form in the logical design, unless we have all functional dependencies [10].

Furthermore, relational data models require entities expressed in a certain form, and eventual structural changes to an entity oblige changes to all the instances of that entity in the database. Thus, it is not possible to change a single instance without also affecting the whole database [7].

This is why the hierarchical concept has not been completely abandoned. It is a concept embedded in the chunking and categorization theories, two closely related theories that provide that experts organize their mental chunks both hierarchically and semantically. In fact, many authors state that chunks might be linked together in a hierarchical framework [11] and that chunks allow the organization of information by grouping items together in a meaningful way, both hierarchically and semantically. Advocates for hierarchical models argue that their models correspond more closely to the real world; and, as with the relational, even within the hierarchical model a lower redundancy of data is recognized [7]. As a consequence, the resulting data is significantly more accurate. Since the connections among the data are built into the database structure, access time is shorter, thus making the system more suitable for fairly stable databases and with uses that can be precisely predetermined (7:13). The hierarchy concept considered in this research is embedded into the object-oriented paradigm since the object-oriented models have reached a remarkable level of efficiency and ever wider usage [12]. Furthermore, the hierarchy concept of an object-oriented model makes it possible to improve the selectivity of a database accounting system, because data are categorized in pre-defined classes. Because of such rigorous categorization, the system may become more rigid but it will be more efficient [13].

Moreover, object-oriented databases offer solutions to some of the relational database problems. Since object-oriented databases are based on the notions of abstraction and generalization, they are able to capture the semantics and complexity of the accounting data [7]. Debreceeny and Bowen [11] concur stating that when a hierarchical abstraction is used to define the accounting data, a higher semantic representation of the reality and a lower time to formulate queries on them are obtained [11]. Other researchers show how an object-oriented model can give a useful contribution for structuring, storing and using accounting data for supporting decisions [14].

Because the relational model tends to hide the semantics of information and to make the management of relationships more difficult, some authors support the hierarchical component of the object-oriented model, given that it retains the capability to organize the information. On the other hand, the relational model allows higher flexibility and a more user-friendly database accounting system.

With these distinctions in mind, we may anticipate clearly recognizable trade-offs between the flexibility of the relational model, and the rigidity/selectivity of the hierarchical model. Trade-offs in the relational database context have also been dealt with by scholars who address the issue of storage techniques to be adopted to meet privacy concerns [15]. In this research chapter, we analyze trade-offs arising when the following issues are managed, both related to hierarchical and relational logic:

- Accounting data encoding schemes;
- Select and update queries on accounting data.

2 Trade-Offs in Accounting Data Encoding Schemes

Data are not usually inserted directly into the database; they are structured in a preceding step on the basis of an encoding scheme. This is crucial to obtain the correct connection of data, especially in attempts to merge two or more existing database accounting systems [16].

One of the most common and critical errors in an encoding scheme is excessive ambiguity and generalization [17]. Hence, the more codes are rigorously structured according to an encoding scheme, the greater the efficiency of queries carried out on the database and the lower the risk of obtaining different results for similar queries. One cause for such problems might simply be due to a lack of control over data entry. Good database design should consider the capacities and incentives of staff who control the data, especially at the stage of initial entry [16]. Therefore, to respect the coding structure, a preliminary database design is needed to define the most correct and representative data encoding scheme. In the Information Technology context, several encoding schemes do exist, such as the scale, the abbreviation, the algorithmic and the vector types [17], but by narrowing the focus on database accounting systems, data are usually entered and managed according to a flexible sequential enumeration method.

The above-mentioned method arranges the attribute values in such a way as to assign a number or a letter to each value. Generally, numbers are more preferred rather than letters, since they can be increased automatically [17]. The main advantages of an enumeration method are the opportunity to deftly manage the data entry, and to apply modifications to the record directly, that is, by adding a new record that substitutes for the previous one.

However, a shortcoming of this method is its lack of significance, since a number has no additional meaning unless it is structured in a predefined articulation. Moreover, enumeration methods are suitable for a short list of values, but are useless for long lists. Having to remember a long list of codes is onerous, especially when no significant ordering principle is being followed. As a consequence, a trade-off between flexibility and selectivity arises from this method.

While a more flexible management of the changes (and thus of the data) is allowed by the relational model, it simultaneously provokes a higher dispersion of data and thus a higher difficulty to achieve a clear identification of the several records. Such a trade-off will be more evident when an update of data has to be obtained. As an example, in case of a data entry error, the need to correct that value is satisfied by adding a new row with an increased code number. In this way the new record substitutes for the older one, and all the records correlated to the former will have to be linked again to the latter. Because of the weaker data organization, a lower level of data accuracy results, giving rise to new difficulties for making changes traceable.

Another widely used method for managing data is based on variants, that is, the partitioning of a set of values into disjoint categories, where each category is further divided into other subcategories, until a final desired level is attained.

Following this logic, each category has a meaning in itself, and each subcategory adds a further, refined significance [17].

Using this method, the selectivity is clearly improved, because the articulation of a set of code blocks allows a higher level of abstraction and thus a representation of data closer to the reality. The higher level of selectivity is due to the possibility of collocating data in a preliminary defined structure from the first data entry onwards. In doing so, the user is forced to respect that articulation, and data dispersion is avoided. Moreover, according to this method, when a record is entered, it immediately acquires a precise meaning—that is, a certain destination (variants on a list of persons could define whether they were clients or suppliers), or a certain level of priority (variants can define different client clusters based on their strategic relevance).

A set of variants can also be helpful in managing data entry errors, because a new variant value can be assigned to that record. Using the variant method also improves the accuracy results, because even if the new variant is different from the previous one, it still refers to the same object, so that dispersion is avoided. As can be seen, on the one hand, variants are helpful for changing records, but, on the other hand, they still represent a constraint. Even for this method a trade-off does exist between selectivity and flexibility. The higher structuring of data affords a higher selectivity but also a loss of flexibility (as well as a greater effort for data entry). In fact, the existence of a rigid set of variants represents an obstacle when a new object has to be embedded inside the database accounting system.

3 Trade-Offs in Queries on Accounting Data

As observed by some scholars, a hierarchical structure is suitable for improving the process of information selection, especially in a web context, where a small number of specifically desired documents must be retrieved from an enormous amount of information [18]. Also, research on accounting database systems shows that there is a huge interest among scholars in improving the performance of queries done on hierarchical enterprise data [19].

Figure 1 shows a hypothetical example on how to manage a client, supplier and agent master. Based on the research of Debreceeny and Bowen [11], a simplified schema is proposed to manage personal data, starting with the highest level of the hierarchy that describes a generic person.

Such a table is divided into two specialized “subtables,” one for clients and one for suppliers. Each subtable automatically inherits the attributes of its parent. The inherited attributes are shown in *italics*.

The client table adds a link to a “geo_area” table and to a “agent” table. The supplier table adds a link to a “cond_pay” table. The “agent” table inherits attributes of its parent “suppliers,” given that “agent” is a specialization of “supplier.” As can be seen, each child has the same attributes of its parent and some specialized attributes more.

In order to select information from the child levels in such a hierarchical accounting database system, the user only needs to include the specialist table in the query to obtain a high level of accuracy. Some authors have shown that where information is organized in a hierarchical structure, the deeper the query is carried out, the higher the accuracy achieved, since the lower levels include the information of their ancestors [20]. Empirical results show that organizing data according to a hierarchical structure allows a higher level of abstraction, thus providing a better basis for problem solving and an increased query performance, in particular with regard to query accuracy [21]. Furthermore, selectivity is improved, because the queries can merely recall the table containing the attributes desired in order to retrieve the information.

The same results may be obtained in a traditional relational model but in a more complex way.

Queries would require the end-user to recall not only the attributes of one table, but also the attributes of associated tables in order to retrieve complete information, since, in a complex relational system, data are distributed and linked to each other. In addition, queries would require the end-user to specify how those tables must be joined together [11].

In spite of the above-mentioned advantages, the main disadvantage related to a hierarchical accounting database system is related to the data update. As each table inherits attributes from the related parent, when time comes to update an attribute, what is required is an update query for each table containing that attribute. For example, in the case in which an agent changes his/her email address, the update query will have to be formulated three times: once for the “agent” table, once for “suppliers” and once more for the “person” table.

Another problem of hierarchical accounting database systems concerns the rigidity for managing nonhierarchical realities and realities where ad-hoc queries are not common [7]. Therefore, use of the hierarchical structure is limited to relatively few situations.

4 Managing Trade-Offs Between Hierarchical and Relational Database Accounting Systems

With the above considerations in mind, trade-offs between flexibility and selectivity arise for the choice of both the accounting data encoding scheme and the entire database structure.

It is clear that a hierarchical structure is more suitable for improving the selectivity of an accounting database system, despite some difficulties and limitations, and that for a quality accounting system, selectivity is one of the most relevant features.

In order not to lose the advantages of a hierarchical structure and, at same time, to favor an improvement in the flexibility of the system, the best solution would be an integration of the hierarchical and the relational database accounting systems.

The first task is to determine which accounting database structure is the most suitable; the second is to find the most appropriate encoding scheme for managing data. Given that the most recent literature shows that the relational structure predominates in the database field, a solution has to be found for incorporating hierarchical data coding into the relational model.

One solution is to use a set of variants, able to extend the initial code representing the parent, through the use of multiple successive code blocks representing the children. In this way, when an extended code is entered, it simultaneously embeds all the distinctive characteristics of the data. Table 1 depicts an extended code related to the previous example of Fig. 1.

Using this technique, the first element of the code, related to the “category,” is classified as 1 or 2, where 1 identifies the clients and 2 the suppliers category. The second column of the table represents a sub specification of the first, for example where “ID_category” is 1 (or 2) and “ID_sub_category” is 01, the latter could identify a specific client (or supplier) category. The third column refers to an auto incremental code that allows the differentiation of categories and subcategories and the enumeration of the elements belonging to them.

The main advantage of this representation relates to the higher selectivity arising from the rigidity of the structure. The code allows the retrieval of

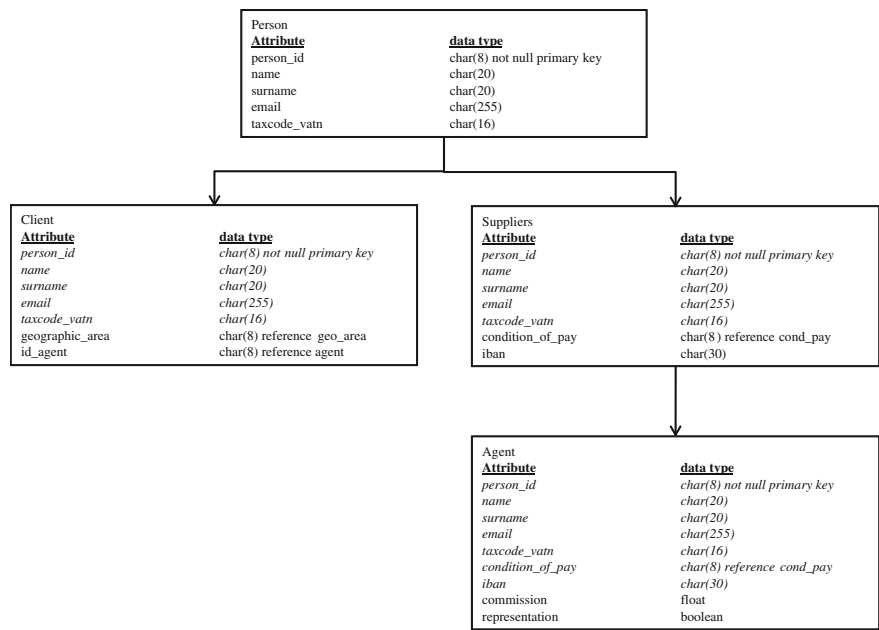


Fig. 1 Hierarchical accounting database system

Table 1 Hierarchical accounting data coding: first solution

ID category	ID subcategory	ID progressive	...	...
1	01	001	...	...
1	02	001	...	...
1	03	001	...	...
1	03	002	...	...
2	01	001	...	...
2	02	002	...	...
2	03	001	...	...
2	02	003	...	...

information through more highly targeted select queries because they can be focused on each element of the extended code. Most important to the focus of this chapter, such a table can be part of a relational accounting database model.

On the other hand, while the higher rigidity allows for a better degree of selectivity, it also introduces a major constraint due to the increased costs for data entry. Table 2 offers an alternative solution that, while still using variants, tries to work around the rigidities of the previous method. In the example given, “supplier table” inherits attributes of “person table” and adds some specialized attributes such as “condition_of_pay” and “Iban”; the example shows how to use variants to manage possible changes in the condition of payment and/or in the Iban.

In this case, the hierarchical relationships are managed through a unique column “variant_id” that recalls the primary key “id_suppliers.” Using such a set of variants allows one to link parent and children records, thus avoiding an excess of rigidity. In fact, when a new record has to be added, a new row is inserted and a value to “variant_id” is assigned. Such a value represents the hierarchical relation, if it exists. If this value is set to zero, it means that no hierarchical dependencies are defined for that record. For this reason, such a model can also be suitable for managing non hierarchical realities. Even when a modification has to be applied on one or more attributes, it is possible to simply add a new record with a different primary key value, recalling the same “variant id” of the erroneous one.

The solution represented in the Table 2 also guarantees the monitoring of historical data and not losing track of information that could be useful for

Table 2 Hierarchical accounting data coding: second solution

Id_suppliers	Condition_of_pay	Iban	Variant_id
3	A01	IT06....004512	0
12	C03	IT06....005541	0
20	C06	IT06....004512	3
22	A01	IT06....005541	12
99	A01	IT06....005543	12

achieving data analysis and reporting. In such a model, selectivity and accuracy are improved, since variants allow the management of linkages between parent and children records only when they exist.

5 Conclusions

Ever since relational models were introduced, there has been a steady shift from hierarchical to relational models. This shift is due to numerous advantages recognized in the relational model—for example, the ability to manage the completeness of data through a series of tables and relations.

Multiple studies have focused on how to convert hierarchical models in relational models, rather than on how to integrate them.

The concept of hierarchy, however, survives thanks to its structure, which allows a representation of data that more closely approximates reality. A hierarchical abstraction used to represent accounting data allows a high semantic representation of the reality and a relatively low time to formulate queries.

The advocates for relational models recognize its many advantages, such as data independence, higher flexibility, and the minimization of data redundancy. Companies implementing database accounting systems need to improve the selectivity of their models, both to control the accounting data and to make efficient and accurate queries. At same time, companies need to adopt the most flexible solution.

Major trade-offs arise from two critical features: (a) the encoding scheme chosen for managing data entry and storage; and (b) the database structure implemented for obtaining the best balance between hierarchical and relational advantages. In fact, the hierarchical model involves a higher degree of rigidity but a better selectivity of the system, whereas the relational model involves higher flexibility but lower selectivity and more complexity.

The aim of this research has been to weigh the trade-offs between the two models (hierarchical and relational) and to determine to what extent the hierarchical structure might improve the quality of a relational accounting database system. A hierarchical structure can provide an important contribution to data management within the relational model. In this research, two key solutions are proposed on how to integrate hierarchical and relational logics for managing the above-mentioned trade-offs and, at same time, for obtaining an advantage in terms of selectivity and flexibility. Both of the proposed solutions require the use of variants, intended as specializations of a more generalized code.

The first solution is based on a concatenation scheme, where the sum of the defined variants represents the primary key of that record. This approach allows the highest level of accuracy and selectivity in data entry, storage and query, but leads to higher efforts for the end-user, since he/she must to insert data in accordance with a very rigid structure, and with a loss of efficiency in terms of the time needed for data entry.

With the second solution proposed in this research, all variants are managed through a column that recalls the primary key of the parent record. As a result, such an integrated model can manage hierarchical parent–child relationships through the relational model.

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Interactive Data: Technology and Cost of Capital

S. Sarah Zhang, Ryan Riordan and Christof Weinhardt

Abstract We examine the introduction of the voluntary filing program (VFP) by the Securities and Exchange Commission (SEC) for the introduction of XBRL (eXtensible Business Reporting Language), or Interactive Data as called in the US. XBRL is a machine-readable standardized format for financial reports. The VFP allowed firms to file annual and quarterly reports using XBRL. This program represents a quasi-natural experiment to isolate the effects of an improvement in the information environment of program participants. We study two documented effects of voluntary disclosure, reduced cost of capital and increased information intermediation. Our results show a decrease in the cost of capital, especially for financial and IT firms, and an increase in information intermediation. These effects support existing literature on the adoption of IT in firms and voluntary corporate disclosure and sheds light on the decision to be an early adopter of XBRL reporting technologies.

Keywords Voluntary disclosure · Information · Cost of capital · Financial reporting

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1 Introduction

How does the adoption of technological innovations by firms translate into increased economic value if at all? Previous IS literature have studied this question thoroughly, using different measures (cf. [1]) and analyzing different kinds of IT investments. The IT innovation that we are focusing on is the introduction of a standardized format for corporate filings, called Interactive Data. Recent developments in IT have facilitated increased financial information transparency over the last decades. This change has translated into easier access for investors and regulators to financial reports and firm disclosure, for example via the Electronic Data Gathering, Analysis, and Retrieval system (EDGAR) system. The increased automation of the process has also led to reduced time and cost of filing financial reports. The Internet and other communication technologies have also led to an enormous decrease in the time and expense of accessing and analyzing financial reports and other valuation relevant disclosure. Our goal in this chapter is to apply existing measures of economic success on a quasi-natural experiment. We specifically analyze the economic effects of the voluntary filing program (VFP) for the introduction of eXtensible Business Reporting Language (XBRL), or Interactive Data as it is called in the US. XBRL is an Extensible Markup Language (XML) based format which is geared toward financial information and allows tagging of this information using standard taxonomies. We expect that this exogenous variation has short-term effects on the returns and liquidity of participating companies as well as more long-term effects on their cost of capital and their following analysts.

In April 2005, the Securities and Exchange Commission (SEC), the regulating authority in the US, introduced the VFP for the introduction of XBRL, designed to make financial reports more accessible and to reduce the cost to prepare and analyze these. On April 13th, 2009, the SEC made the filing in Interactive Data format compulsory by adopting rule 33-9002 [2]. The mandatory SEC program was implemented by a staggered introduction over three years. In the first year, large U.S. “Generally Accepted Accounting Principles” (GAAP) filers with a public float over \$5 billion were required to use Interactive Data. In the second and third year, the rest of U.S. GAAP and “International Financial Reporting Standards” (IFRS) filers followed. The SEC’s goal by adopting XBRL is to enhance transparency and to facilitate investor’s financial reports analysis. The machine-readable format significantly enhances the speed of financial statement analysis by investors. Transparency may be increased with XBRL usage as investors can electronically download and analyze reports in a standardized structure and format with pre-defined semantics and taxonomies (dictionary of terms). They are able to use information directly from financial statements in financial applications with little data transformation and interpretation. However, the SEC’s regulatory requirement that all public companies use XBRL was introduced with little analysis of the impact of XBRL on firms and markets.

In this chapter, we study the effects of voluntary early adoption of Interactive Data. Specifically, this chapter investigates the market effects after the introduction

of Interactive Data, which qualifies as an instance of voluntary corporate disclosure. We test two hypotheses found in the literature of possible effects of voluntary disclosure. These are more precisely reduced cost of equity capital and increased information intermediation. Our results are statistically significant on the reduction of the cost of capital of the participants as well as on increased information intermediation. We believe that our proposed research questions are interesting and relevant for researchers as well as practitioners. Our analyses will shed light on the question how voluntary interactive disclosure influenced firm's costs of capital and access to information by investors.

The remainder of the chapter is structured as follows. [Section 2](#) develops the examined hypotheses with respect to related work. [Section 3](#) provides information on the data and the sample selection process. [Section 4](#) explains the methodology used. [Section 5](#) provides results and [Sect. 6](#) finally concludes.

2 Hypothesis Development

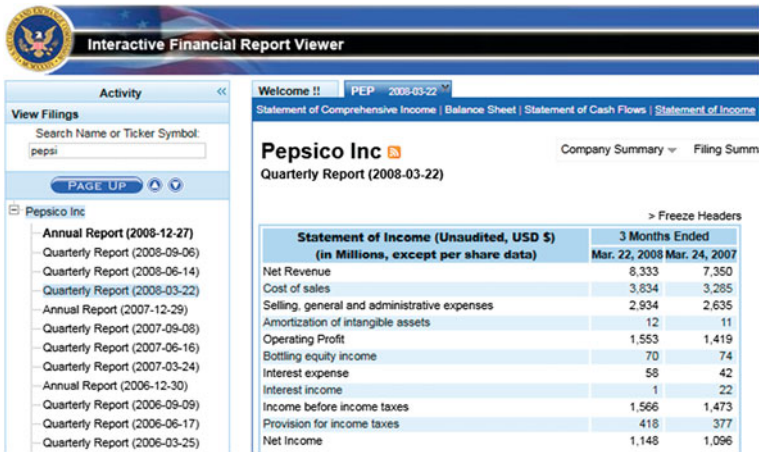
In this section, we discuss the economic and technical improvements for both participating firms and investors that want to gather information about this firm. Furthermore, we show that the introduction of XBRL qualifies for an action of voluntary disclosure of corporate information since it makes the filing information accessible more easily. Therefore, it serves as a signal for better corporate government and innovation of the company. This connects our study to a large body of literature on voluntary and non-voluntary corporate disclosure of information, for instance the introduction of accounting standards in firms. The economic implications of voluntary disclosure have already been thoroughly analyzed in accounting literature. Voluntary Disclosure is also playing a more vital role in IS since the disclosure of financial information as well as the retrieval have become easier and more automated.

From the perspective of investors, Interactive Data enhances various aspects of their work with financial data. Formerly, firms submitted an html file and a pdf document of their report to the EDGAR system. An exemplary statement of income of Pepsi Co. is shown in [Fig. 1](#). The introduction of Interactive Data has made it possible to find, analyze, and compare financial data of participating companies in the “Interactive Financial Report Viewer”, as depicted in [Fig. 2](#). Next to the apparent new features of the new platform, the standardized format itself offers various opportunities for analysts and traders. Using the old format, analysts had to go through financial reports manually to find a specific value and copy and paste it into their spreadsheet or database.

The voluntary provision of financial reports in Interactive Data format facilitates the work of analysts since it makes financial information automatically processable and comparable. This might play an important part in the decision of analysts whether to cover a specific stock in their analysis or not.

PEPSICO, INC. AND SUBSIDIARIES CONDENSED CONSOLIDATED STATEMENT OF INCOME (in millions except per share amounts, unaudited)		
	12 Weeks Ended	
	3/22/08	3/24/07
Net Revenue	\$ 8,333	\$ 7,350
Cost of sales	3,834	3,285
Selling, general and administrative expenses	2,934	2,635
Amortization of intangible assets	12	11
Operating Profit	1,553	1,419
Bottling equity income	70	74
Interest expense	(58)	(42)
Interest income	1	22
Income before income taxes	1,566	1,473
Provision for income taxes	418	377
Net Income	\$ 1,148	\$ 1,096

Fig. 1 Exemplary filing in HTML format



Statement of Income (Unaudited, USD \$) (in Millions, except per share data)		
	3 Months Ended	
	Mar. 22, 2008	Mar. 24, 2007
Net Revenue	8,333	7,350
Cost of sales	3,834	3,285
Selling, general and administrative expenses	2,934	2,635
Amortization of intangible assets	12	11
Operating Profit	1,553	1,419
Bottling equity income	70	74
Interest expense	58	42
Interest income	1	22
Income before income taxes	1,566	1,473
Provision for income taxes	418	377
Net Income	1,148	1,096

Fig. 2 Exemplary filing in interactive data format

2.1 XBRL Literature

The literature on XBRL has been growing in the last years and involves various aspects of the topic, such as quality assurance and technical issues as well as positive effects on information intermediaries and investors. Assurance issues involve extensions of standard taxonomies which hinder the comparability of reports as well as errors in the reports filed. Boritz and No [3] analyze the quality of XBRL filings and suggest a quality assurance program to validate the filings. Debreceny et al. [4] point out several technical research directions concerning XBRL, among others new taxonomies, financial statement assurance, and

interoperability issues. Arnold et al. [5] find that XBRL introduction improves in incorporation of risk information in financial decision making of investors.

Research on the economic effects of voluntary XBRL introduction is still relatively sparse. One line of literature analyzes company characteristics of voluntary early filers. Premuroso and Bhattacharya [6] examine whether early and voluntary participants of the voluntary filing program demonstrate superior corporate governance and operating performance relative to their non-participating peers. Callaghan and Nehmer [7] find that participating companies are bigger, less financially leveraged and have lower corporate governance rating. They conclude that the companies voluntarily adopt XBRL in order to improve their corporate governance appearance. As from interviews with business managers in Canada, Germany, South Africa, and the U.S. (cf. [8]), companies that introduce XBRL were further expecting to attract a broader group of investors and lower cost of capital. Another line of literature concentrates on the direct effects of voluntary XBRL filing on stock markets. Yoon et al. [9] examine whether XBRL adoption reduces information asymmetry in a stock market context. Hodge et al. [10] show that XBRL increases market transparency. We contribute to the second line of literature. We are not able to control for the selection bias of participating companies, but rather characterize the overall effect on the participating company with respect to their cost of capital and the number of analysts following. Additionally, we further analyze different groups of participants to detect the groups benefitting most from the early adoption. From the very different motives of VFP participation (as presented by [7] and [6]), we assume different motives for companies of different industry groups and of different degrees of innovation, for example Information Technology companies compared to Utilities companies. Specifically, IT companies and financial service companies seem to have stronger incentives to participate in the VFP in order to acquire knowledge on XBRL in advance and to have the know-how to offer and consult their clients.

2.2 *Cost of Capital*

The measurement of the economic value of information systems has been an important and prevailing research question during the last decades. We apply a classic event study methodology as formalized by MacKinlay [11] and applied by Subramani and Walden [12]. The latter analyzed the impact of electronic commerce initiatives on the market value of companies using abnormal returns. Event studies have become an established method to measure the success and economic value of IT investments and the announcements thereof. While previous literature has concentrated on the short-term effects of IT investment on returns several days after the event, our study also considers long-term effects on the cost of capital of VFP participants.

The cost of capital hypothesis states that companies increase their level of voluntary disclosure to reduce adverse selection risks for investors. A theoretical

foundation is provided by Klein and Bawa [13], and Barry and Brown [14] who suggest that higher disclosure reduces estimation risk which represents uncertainty regarding an asset's return or payoff distribution. If this risk is non-diversifiable, investors will demand an incremental return for bearing the information risk. Further analysis is provided by Easley and O'Hara [15], who analyze how private and public information affect the cost of capital. For firms with a low level of public information in relation to private information, investors require higher returns to offset uncertainty about asset returns. As a result, firms with high levels of disclosure, and hence low information risk and private information, are likely to have a lower cost of capital than firms with low disclosure levels and high information risk.

Botosan and Plumlee [16] present empirical evidence that the cost of equity capital decreases with an increase in the transparency of annual reports [16]. In line with these results, Gray et al. [17] state that the primary goal of firms is to lower the cost of capital. They do this by voluntarily disclosing information and thereby reducing "information risk" and investor uncertainty about the quality of the firm and the expected returns from its securities. Therefore, we expect positive abnormal returns on a short-term basis after the filing of the first XBRL report and a significantly lower level of cumulative abnormal returns long-term as a sign for lower cost of equity capital. Therefore, the first hypothesis is:

H1: The voluntary introduction of Interactive Data leads to a decreased cost of equity capital for participants.

We measure abnormal returns with two different asset pricing models, the market model as in [18] and the Fama-French Three-Factor Model (cf. [19]).

2.3 Information Intermediation

The second hypothesis on information intermediation captures the positive effects on investors and analysts. Existing research on corporate disclosure suggests a negative relationship of information disclosure and information asymmetry (cfs. [11, 20]). A higher level of voluntary disclosure enables more analysts to access and aggregate information. This increases the number of analysts following a specific stock. Bhushan [21] argues that voluntary disclosure lowers the cost of information acquisition for analysts and hence increases their supply. Lang and Lundholm [20] indicate increased investor following with a higher score of informativeness of a firm's disclosure policy. Fang and Peress [22] find that breadth of information dissemination has an influence on stock returns. They discover a significant return premium on stocks with no media coverage which can also affect the cost of equity capital. Furthermore, voluntary disclosures also might help lesser known firms to make investors aware of their existence, as modeled theoretically by Merton [23]. As indicated above, Interactive Data has several advantages for analysts and investors. It enables them to follow a specific stock more easily and therefore attracts more analysts. Thus, H2 is as follows:

H2: The number of analysts following increases with the introduction of Interactive Data.

We adopt the measure of [20], number of analysts following, as proxy for information risk.

3 Data and Sample

Market data is used from Compustat and Thomson Reuters Tick History. For the identification of the participating companies, we use the report data from the 162 participating companies between April 4, 2005 and March 23, 2009 from the SEC website. The data cleaning is described in Panel A of Table 1. We exclude companies, like trust funds and ADRs (American depository receipts) since we are interested in effects of increased information and transparency proxied through Interactive Data on common stocks. We also remove firms with mergers, stock splits or other kinds of corporate actions (reverse splits, etc.) during our estimation period in order to exclude distorting effects in our data. Our final data sample consists of 92 US companies from 10 different industry groups, as shown in Table 1, Panel B. The companies were listed both on the NASDAQ and NYSE and filed their first XBRL report between April 4, 2005 and March 2009. The number of reports increased constantly, from 27 reports between April 2005 and March 2006 to 254 reports between April 2008 and March 2009 (cf. Table 1, Panel C). The number of first reports, i.e. the number of starting participants, was also steadily increasing in this period of time.

Table 2 depicts distributional characteristics of participating companies. From Compustat, we collect per-share data for daily close prices in dollars (*Close*), daily P/E ratios (*P/E*), and daily market capitalization in millions of dollars (*Market*). *NEst* denotes the number of analyst estimates in one month. The participating companies range from big companies like General Electric and Microsoft to smaller companies like Bowne and Co. and ICU Medical Inc. They belong to ten different industry groups, with Information Technology, Energy, and Financials representing the largest groups of participating companies (cf. Table 1, Panel B).

For the analysis on information intermediation, we use earnings estimates from Institutional Broker's Estimate System (I/B/E/S), specifically one year ahead and two year ahead EPS estimates as well as the forecasted long-term growth rate. Additionally, we cluster our sample into groups. Firstly, we analyze the firms in the industry group "Information Technology and Finance" (*ITFI*) and firms not in this group (*non-ITFI*) separately. Secondly, we distinguish between the first filers in an industry (*FIRST*) and those participants who are not (*non-FIRST*). We do this to determine if there are industry and time idiosyncratic effects.

Table 1 Event study sample distribution

<i>Panel A: Sample creation procedure</i>		
Sample	Change	Number of companies
All filers between April 4, 2005 and March 23, 2009		162
All companies without trust funds	(35)	127
Companies with available RICs	(8)	119
Companies without ADRs	(19)	100
All data available and non pink-sheets	(2)	98
Without stock splits	(6)	92
<i>Panel B: Industry groups</i>		
Industry group	Industry group ID	Number of companies
Materials	1,000	8
Consumer discretionary	2,000	8
Consumer staples	3,000	6
Health care	3,500	8
Energy	4,000	10
Financials	5,000	13
Industrials	6,000	14
Information technology	8,000	17
Telecommunication services	8,600	1
Utilities	9,000	7
Total number of companies		92
<i>Panel C: Report counts</i>		
Year Apr–Mar	Number of reports filed	Number of first reports filed
2005/06	27	5
2006/07	105	15
2007/08	192	21
2008/09	254	51
Total number of reports	578	

Table 2 Distributional characteristics of participating companies

Variable	Mean	Min	Max	25th % tile	Median	75th % tile	Standard Deviation
Close	40.245	2.324	357.395	24.599	34.698	47.304	37.822
P/E	16.948	−110.726	202.047	8.424	14.152	18.996	39.003
Market	29,817	58	335,447	4,895	10,909	25,577	54,736
NEst	33.861	1	109	21	34	45	18.274

4 Methodology

In order to test our hypotheses, we use an event study and a panel regression. The event study measures the effect of a voluntary XBRL introduction on the cost of equity capital of a company which represents the financing opportunities of

investments and innovations in the future. Information intermediation is important since it represents the information asymmetry between investors and firms. Thus, higher information intermediation caused by an easier information retrieval can lead to an increase in analysts following the specific stock.

4.1 Cost of Capital: Event Study

Event studies have become commonly used instruments to identify and measure the impact of the announcement of new, value-changing information on stock returns. We apply an event study methodology as described in MacKinlay [11]. In detail, different asset pricing models are fitted to measure abnormal stock returns during the event windows in order to test for differences in the distribution of abnormal returns. The null hypothesis for these tests is that the event has no impact on the distribution of returns. The filing of the first Interactive Data report is set as Day 0 for each participating company and we measure the OLS model coefficients during the estimation period (day -211 to -11) in order to compute expected returns and thereby cost of equity capital. The prediction errors during different event windows (13 days from day -10 to $+2$, 21 days from day -10 to $+10$, and 41 days from day -10 to $+30$) can be interpreted as the abnormal returns during these periods, more precisely $AR_{it} = R_{it} - E[R_{it}|X_t]$. The event windows are relatively short in order to avoid other possible events that might influence stock prices. The first filing with XBRL is taken as our event date since we do not have information on firm's announcement dates for their participation in the SEC's voluntary XBRL filing program. Starting 10 days before the actual event captures possible announcement or information leakage effects in this period.

We follow the standard event study methodology, which compares the difference of abnormal returns before and after the event. Abnormal returns are computed with the market model by Fama et al. [18] and the Fama-French Three-Factor Model (cf. [19]) in order to calculate expected returns and cost of capital. The Capital Asset Pricing Model (CAPM) is implemented to ensure robustness and yields similar results. The statistical market model serves as a basic model which “relates the return of any security to the return of the market portfolio” (cf. [18]):

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (1)$$

with R_{it} and R_{mt} being the return in period t of security i and of the market portfolio respectively.

The Fama-French Three-Factor Model falls into the category of multifactor risk models. It introduces three risk premia, the equity risk premium (ERP), equal to the difference of the market risk premium and the risk-free rate of return (the excess return of the market $r_m - r_f$), the “small minus big risk premium” (*SMB*), as the difference of return of small- and large-cap portfolios, and the “high minus low risk premium” (*HML*) estimated historically as the difference of high and low growth

portfolios. We use the Fama-French factors as provided on Kenneth R. French's website and estimate the factor coefficients b_i , s_i , and h_i using the following regression model:

$$R_{it} = R_{ft} + b_i(R_{mt} - R_{ft}) + s_iSMB + h_iHML + \varepsilon_{it} \quad (2)$$

Daily abnormal returns are summed up to cumulative abnormal returns, $CAR_i(t_1, t_2) = \sum_{t_1}^{t_2} AR_{it} = R_{it} - E[R_{it}|X_t]$, in order to measure the aggregate effects of the event. We apply robust standard test statistics as proposed in [8] to measure the statistical significance of the $CARs$.

4.2 Information Intermediation: Panel Regression

In order to analyze whether the introduction of XBRL facilitates information intermediation, monthly number of EPS forecasts serve as a proxy for the number of analysts following the specific company and therefore for the attractiveness of the stock. We aggregate the number of all monthly estimates from I/B/E/S ($NEst$) and perform a panel regression on this data by using a dummy variable representing the time before and after the introduction of XBRL:

$$NEst_{i,m} = \alpha_i + \delta XBRL_{i,m} + \varepsilon_{i,m} \quad (3)$$

where m denotes the month and i the cross section. To test the impact of VFP participation on information intermediation, a panel regression with firm fixed effects is estimated (firm dummies are not reported for brevity) and tested using robust standard errors.

5 Results and Interpretation

In the first part of our analyzes, we event study results using cost of capital models (the market model and Fama-French Three-Factor Model) to test the hypothesis that the SEC's voluntary filing program decreases the cost of capital. Firms are further clustered by industry group, specifically Information Technology and Financials (ITFI) and other industry groups, and by being a first adopter in an industry. We assume stronger motives for these industry groups to participate in the program, since the introduction of XBRL can have strategic relevance for these firms, for example consulting expertise, and therefore the participation might have a stronger effect on these firms. In the second part, we conduct a regression analysis in order to show the effect of XBRL introduction on the number of analysts following the specific stock.

5.1 Cost of Capital

Table 3 provides results for the explicit cost of capital models. Panel A shows results with the market model, and Panel B gives the results based on the Fama-French Three-Factor Model. Focusing on the 2 days event window, the results yield positive (though no significant) short-term abnormal returns after the first filing of XBRL. For the results on the more long-term cost of capital, we find significant results for an event window of 41 days and the industry groups ITFI. For this subsection, both models have negative coefficients and all are significant at the 5 % level.

We thus conclude that voluntary XBRL filing leads to a reduction in the cost of capital of firms in the IT and Financials industry. Results are not significant for the other industry groups, leading to the conclusion that filers in the ITFI group experience a stronger negative effect on their cost of capital than other industry groups. The effect of the first XBRL filing is also shown in Fig. 3, which also demonstrates a clear downward tendency of CAR for ITFI group firms.

Furthermore, we carry out the same analysis with the group of firms being the first filer in their industry group and those which are not. From the result presented

Table 3 Event study analysis of abnormal returns grouped by industry group

Panel A: Market model					
Event window	IT, financials	N	Average CAR	p-value	
[−10;2]	All	92	0.0586	0.5757	
[−10;2]	0	62	0.0619	0.6278	
[−10;2]	1	30	0.0517	0.7789	
[−10;10]	All	92	−0.1035	0.3235	
[−10;10]	0	62	−0.0081	0.9492	
[−10;10]	1	30	−0.3006	0.1102	
[−10;30]	All	92	−0.2417	0.0227	**
[−10;30]	0	62	−0.1402	0.2739	
[−10;30]	1	30	−0.4514	0.0193	**
Panel B: Fama-French three-factor model					
Event window	IT, financials	N	Average CAR	p- value	
[−10;2]	All	92	−0.0046	0.9650	
[−10;2]	0	62	0.0109	0.9321	
[−10;2]	1	30	−0.0365	0.8429	
[−10;10]	All	92	−0.1595	0.1296	
[−10;10]	0	62	−0.0491	0.7003	
[−10;10]	1	30	−0.3875	0.0422	*
[−10;30]	All	92	0.2332	0.0227	*
[−10;30]	0	62	−0.1194	0.3509	
[−10;30]	1	30	−0.4684	0.0155	*

**Significant on a 5 % level

*Significant on a 10 % level

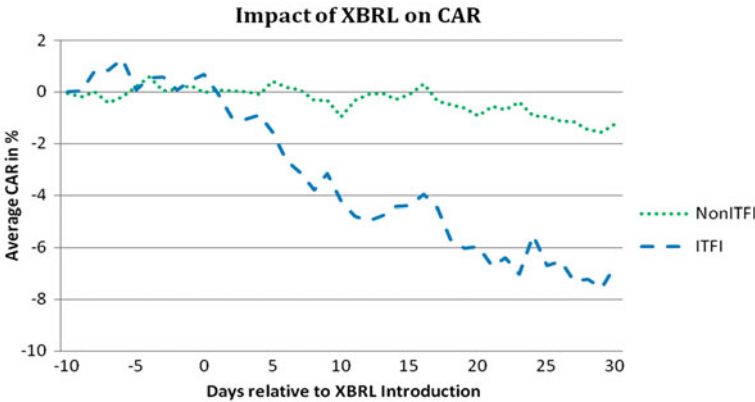


Fig. 3 Impact of XBRL on CAR (Fama-French three-factor model, by industry group)

Table 4 Event study analysis of abnormal returns grouped by first adopters

Panel A: Market model				
Event window	First adopter	N	Average CAR	p- value
[−10;2]	All	92	0.0586	0.5757
[−10;2]	0	81	−0.0233	0.8345
[−10;2]	1	11	0.6613	0.0507 *
[−10;10]	All	92	−0.1035	0.3235
[−10;10]	0	81	−0.2162	0.0551 *
[−10;10]	1	11	0.7266	0.0346 **
[−10;30]	All	92	−0.2417	0.0227 **
[−10;30]	0	81	−0.3598	0.0017 **
[−10;30]	1	11	0.6284	0.0612 *
Panel B: Fama-French three-factor model				
Event window	First adopter	N	Average CAR	p- value
[−10;2]	All	92	−0.0046	0.9650
[−10;2]	0	81	−0.0965	0.3877
[−10;2]	1	11	0.6723	0.0475
[−10;10]	All	92	−0.1595	0.1296
[−10;10]	0	81	−0.2931	0.0100
[−10;10]	1	11	0.8248	0.0194 *
[−10;30]	All	92	−0.2332	0.0227 *
[−10;30]	0	81	−0.3830	0.0009
[−10;30]	1	11	0.8700	0.0148 *

**Significant on a 5 % level

*Significant on a 10 % level

in Table 4, we can observe significant and positive short-term abnormal returns for first adopters as compared to non-first adopters which experience negative or at least insignificant abnormal returns. As for the cost of capital that we infer from

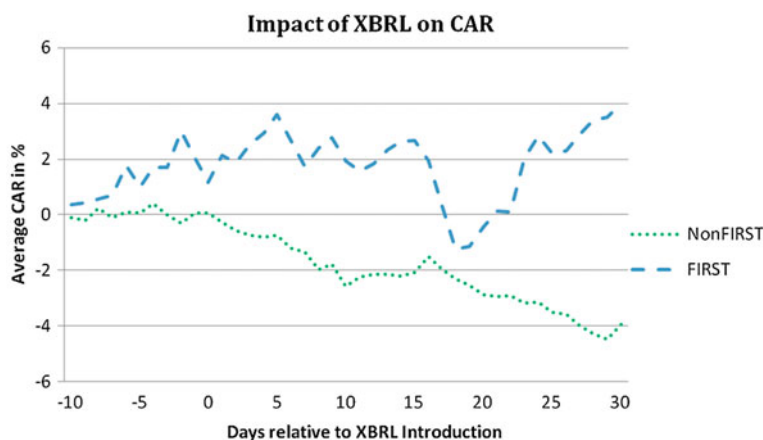


Fig. 4 Impact of XBRL on CAR (Fama-French three-factor model, by first adopters)

more long-term abnormal returns, we find significantly lower cost of capital than before the first XBRL filing for non-first adopters, while the returns of first adopters are still positive and significant. This result is also evident from longer event windows which is shown in Fig. 4. Therefore, we infer two opposing effects for the groups. First adopters seem to experience a positive effect on their abnormal returns. On the other hand, non-first adopters have decreasing effects on their cost of capital which is reflected by the long-term abnormal returns and higher level of transparency.

5.2 Information Intermediation

Table 5 provides results that the introduction of XBRL leads to a significantly increased number of analyst counts, proxied by the number of monthly analyst estimates from I/B/E/S. We find a significant increase in analyst counts consistently for all industry groups. This is consistent with our expectation that the introduction of XBRL enables more analysts to acquire information and therefore increases the supply of analysts covering a stock. The introduction of XBRL however does not have significantly positive results on the monthly number of analysts following an ITFI company. This again supports the assumption that this industry group is driven by other motives that might not be captured by our chosen economic measures. Especially for companies in the industries financial services and IT, there are incentives such as a consulting purposes and investment opportunities to voluntarily adopt XBRL. Additionally, filing through Interactive Data can have had two possible effects. First, our hypothesis, that it increases information intermediation. However, it can also reduce the number of analysts covering a specific stock since information is more easily retrieved by investors

Table 5 Results of analysts counts

Group	Estimate	Standard error	<i>p</i> -value	
All	1.84939	0.8950	0.0388	**
Non-ITFI	1.99969	0.9726	0.0399	**
ITFI	1.52201	1.8965	0.4223	

**Significant on a 5 % level

themselves. Our results indicate that this is not the case and investors still seek analyst's advice, since the number of analyst estimates are consistently increasing for all firms.

6 Conclusion

This study analyzes the effects of a participation of firms in a voluntary SEC program for the reporting through XBRL. In April 2009, the SEC made the program compulsory and the program is being implemented through a staggered introduction over three years. However, it is still unclear what the effects of XBRL reporting were on financial markets. We derive two hypotheses from existing literature. Previous studies suggest that voluntary disclosure reduces the cost of equity capital and increases information intermediation. In our study, we conclude that voluntary filing has positive effects for participating companies. We find significant results on a medium-term level for the cost of capital for the industry groups IT and Financials. This fits in our presumption of stronger motives for specific industry groups to participate in the program, such as consulting expertise. However, we do not find any short-term effects for this group. For the differentiation of first adopter within one industry, we find positive abnormal returns for this group as compared to other adopters, but in the long-term, this effect does not reduce the cost of capital as for the other participants. Our results on information intermediation show an increase in analyst coverage after reporting with XBRL through the SEC's voluntary filing program, proxied by I/B/E/S estimates counts.

We contribute to previous literature on the economic success of IT investment with our analysis of the cost of capital of firms as well as the proxy for information intermediation. Specifically, we take a closer look on direct economic effects, such as cost of capital and information intermediation, of the early voluntary introduction of XBRL in the US. Our results raise further questions whether voluntary adaption has had other effects than those we analyzed which might justify the decision of early voluntary adoption or whether participation might even have been harmful for participating companies, considering costs involved in an early adoption. Future research might involve more in-depth study of information intermediation and analysis of the effects on the cost of equity capital using implied cost of capital models. Further studies can also include an analysis of the mandatory introduction of Interactive Data by the SEC and the differences in the effects of voluntary and mandatory introduction.

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Integrated-Multi-Layered Information Systems in Engineer-to-Order Multinational Business Processes: Managerial, Accounting and Organizational Aspects

Katia Corsi, Daniele Rizzo and Sara Trucco

Abstract This chapter analyzes the contribution of an integrated Information System (IS) to manage processes in an electromechanical multinational company operating in engineer-to-order businesses (ETO-MC). According to literature, ETO business is characterized by dynamic, uncertainty and complexity with special managerial and informational requirements, mainly linked to specific features that distinguish ETO businesses from repetitive manufacturers. The IT integrated application could be an appropriate solution to satisfy the special needs in this context, but in literature there are few contributions about it. The aim of this work is, through a case study, to highlight the possibility of integrated IT solution to better address uncertainty and complexity of an ETO-MC, by providing increased reliability of data, availability on demand and real-time of information, and facilitating creation and development of global knowledge database. Finally this chapter attempts to propose a general model to optimize the implementation of integrated IT solution, and to highlight its managerial, organizational and accounting impacts.

Keywords Engineer-to-order · Information system · Accounting · Large organization

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1 Introduction

Informational requirements of every firm, inherent to process management and to measurement of performances, significantly differ on the basis of their manufacturing systems.

In particular, engineer-to-order (ETO) company performs high product customization, i.e. not standardized production, and every step of own value chain is heavily driven by the client's order, which is highly specific and cannot be strictly managed on the basis of past experience.

Engineer-to-order systems have the following specific characteristics, which influence management and control of the value chain:

1. Dynamic, strongly linked to customization, concerns external flexibility and limited capability to create a capacity of stock materials;
2. Uncertainty, which impacts multiple elements of ETO, like product specifications, arrangement of processes/operations and forecast on sales;
3. Complexity, which applies to individual product (generally composed by a great quantity of components and/or subsystems), to entire set of projects and their interactions (bottleneck in one project affects realization and effectiveness of the others).

Among these features, we believe that the dynamic, as described above, is physiological for every ETO business, and it partially affects the other two features, on which the firm can act to reach competitive advantages.

In competitive markets, ETO companies need to quote the right product at the right price, with precise time and resources constraints, due to concurrent execution of each acquired order. In these companies, continuous development of new products requires effective management of Marketing and Sales (M and S) operations in close and deep coordination with Engineering, as this functional area interfaces M and S to Manufacturing operations, and performs pivotal role since early stage of tendering process, by means of preparing or validating technical proposals and relative costs.

In order to realize the effective quotation process and to mitigate both complexity and uncertainty, ETO firms may use specific IS applications.

This work analyzes the contribution of an integrated IS solution on the operational process, highlighting its implications, through a qualitative case study methodology, focused on an electromechanical multinational company, which operates in engineer-to-order business.

The choice of examined case is determined by its specific features like production of goods, composed of a lot of components and parts, which may be built in different geographical areas, and multinational and multi-layer organizational structure, which increases the degree of complexity and uncertainty before described. These characteristics of the specific business require taking into account several aspects like: variety of education and culture of staff; functional relationships; different languages; and further geographical variables. All these

features affect conceiving, developing and deploying of IS solutions, to be adopted in order to reach the business objectives especially to the extent of the quotation process, as above mentioned.

Aim of our chapter is to highlight the possibility of an integrated IT solution within an ETO company to manage the quotation phase and to facilitate the engineers work. In this way, we attempt to evaluate if uncertainty and complexity, specific features of the ETO-MC, are better managed. Finally we try to review impacts on the following main aspects: Managerial (how to set up and optimize the value chain); accounting (how to affect costing process and profitability calculation); organization (how to ensure alignment between individual/functional objectives, operational processes and IS applications).

Eventually, multi-layer integrated information system will be presented as key enabler—for ETO-MC—to facilitate continuous learning, to build knowledge-database and to provide access on demand and real-time to own global workforce, improving motivation and overall effectiveness of the processes.

This chapter is organized as follows. [Section 2](#) provides an analytical literature review, in particular the [Sect. 2.1](#) analyzes significant studies about ETO systems, highlighting their main features and their managerial and informational requirements; the [Sect. 2.2](#) examines contributions about the integrated IS solution implementation and its managerial, organizational and accounting impacts. In [Sect. 3](#) we identify the literature gap about the integrated IT solution in the ETO-MC and we propose the research question. [Section 4](#) provides the description of the research method. In [Sect. 5](#) we present the empirical research, through the description of the examined case, which is an electromechanical multinational companies operating in engineer-to-order businesses (5.1), and the description of the integrated IT solution used in this company (5.2). In [Sect. 6](#) we illustrate the empirical results, underlining weakness and strength points of the IT solution (6.1) and its pivotal impacts (6.2), emerging from interviews. Final ([Sect. 7](#)) presents conclusive considerations, attempting to answer the research question in order to evaluate if uncertainty and complexity, specific features of the ETO, are better managed by the IT solution in an ETO-MC (7.1). Finally we provide some suggestions for future researches (7.2).

2 Literature Review

2.1 Overview of Engineer-to-Order Literature

Literature reports proliferation of ETO definitions, depending on variety of both research streams and business contexts [1]. Consolidated classification of manufacturing systems defines ETO as “*company that reengineers products after getting the order and before starting production*” [2]: It means that the ETO companies produce unique products designed to customers specifications.

Among the several definitions emerging from the literature, we can distinguish two main types, although they are closely related to each other, which can be summarized as follows: the former are structural types, arising from engineering and technical-productive studies, and the latter are dynamic-competitive ones, mainly resulting from studies on the managerial field.

In the first type, the ETO definition is linked to the value chain and to the decoupling point concept. The value chain can be defined as a network of units, or organizations, involved in different processes and activities (for example design, fabrication and procurement, final assembly and shipment), that produce value in the form of products and services to the end users, and even to the internal clients [3, 4]. In this conceptual framework, decoupling point (DP) [5–7] is defined as “*a point in the manufacturing value chain for a product, where the product is linked to a specific customer order*” [8].

Accordingly, DP divides supply chain in two major groups of activities: upstream ones (forecast driven) and downstream ones (customer-order driven).

The DP may be located at different stages of the supply chain of each company, as listed in the following examples [8]:

- At the shipment, it individuates “make to stock”;
- At the final assembly, it individuates “assemble to order”;
- At fabrication and procurement, it individuates “make to order”;
- At the design stage, it individuates “engineer to order”.

When DP is set at the design stage, it is the case of ETO companies, which are characterized by high degree of customization [9], which is considered physiological, in addition to be just a general competitive variable.

The second type of definitions (more consistent with our work) highlights the critical competitive aspects, because the ETO products are usually complex and customers are extensively involved in design and manufacturing phases.

In particular empirical studies show that basic competitive pre-requisites in ETO companies are price, design ability, delivery speed, delivery reliability, quality and flexibility [10, 11]. In order to optimize simultaneously above mentioned variables, it is necessary to efficiently manage the whole ETO process, with particular attention to non-physical activities like Marketing and Sales, Tendering and Design [12]. These phases play a crucial role in the ETO process for managing dynamic, complexity and uncertainty of these systems [13, 14].

According to previous considerations, in the ETO companies some specific managerial and informational needs are highlighted.

With reference to managerial needs, the pressure to reduce costs and cycle times, and maintaining high quality, imposes an integration of sales and marketing processes with manufacturing. In this integration the Engineering department is deeply involved in order to facilitate quotation process and to improve effectiveness of overall value chain [15]. The quotation process is a pivotal phase in every ETO company [16, 17] because in this phase it is necessary to underline the ability to find an optimal solution according to the customers’ needs and to assure high

quality, short lead time, high productivity of the work in the manufacturing activities, which are all needed to realize generally complex products and services, characterized by high costs and long lead times. According to literature, “*aim of the quotation phase is to evaluate a new project in terms of resource capacity, requirements and costs, with an acceptance level of risk for the manufacturer*” [18]. This assigns the Engineering a crucial role to success of every quote and this function has to work simultaneously on several designs, both for executing acquired orders and for securing new business, creating in this way a potential bottleneck of these resources [13, 19]. Engineers have to prepare product design specifications, based on the customer requirements, along with information about functionality and costs of products, and provide all data needed in the production process, in particular in the quotation phase [5–8]. It is undoubted that the Engineers, mainly involved in design and quotation phases, play an important role for success of whole process, from customer order to production and vice versa. So they strongly contribute to realize the integration between Marketing and Sales (M and S) and Manufacturing, that even depends on several factors, as: The product complexity, which is connected to their business segment; degree of customization which can range from modular type (when the products are composed by standard components or standard modules) to extreme type (when the products are completely customer driven); delivery time relevance [10] and company size.

Closely related to these managerial implications, in the ETO companies there are also specific informational needs. The features, which distinguish the ETO manufacturers from the repetitive ones (i.e. unique products versus standard products; project driven versus forecast driven; project quotes versus price list; cost variance to standard versus cost variances to original estimate; high number of engineering changes, deep bills of materials), require a relevant information flow in order to facilitate the integration among the activities of entire value chain (in particular the marketing and engineering), and to control and re-plan as required. This causes intense efforts for collection, storage and diffusion of information, for both current and past projects, together with necessary and continuous update of this data, in order to ensure their validity and applicability against new market requirements, because conditions and cost drivers may change during order negotiation phase [13].

A principle information problem is linked to the existence of one-of-a-kind products: every product is different from anything else they previously engineered and built. This requires new information and brings new challenges that cannot be solved by traditional repetitive-manufacturing solutions [20]. An important managerial choice can be represented by repeat business: Repeat sale of a product designed for one customer but sold to one or more other customers; repeat business for the same customer but for a different product; repeat business for the same product and the same customer. These solutions allow costs reduction, even if they do not necessarily generate higher profits [9, 10].

Another fundamental strategic solution to manage this information problem can be the utilization of information and organizational tools in order to integrate marketing and manufacturing functions. In particular these tools can be

represented by IS systems able to handle the business information and to share them by supporting decision-making processes and by easing the engineering department [15]. These IS solutions require a common database useful for tendering, design, procurement and project management, which generates and shares knowledge in the organization. Even if each order is unique and one of a kind, some contributions highlight the importance to have a database, which allows efficient reuse of previously designed components, despite new products variants [18]. This permits ETO companies to satisfy, with timeliness and efficiency, customers' requirements.

Although cumulative knowledge is necessary, it is difficult to create it, as engineers generally do not have efficient methods or tools to manage information about past projects and translate them to the new ones [21]. Some contributions highlight the need to formalize knowledge and information of the products through IT systems in order to build the models that contain knowledge and information about the products and, based on this, they are able to derive new specifications for product characteristics and their life cycle properties [22]. These solutions have been formalized for relatively simple products, but in recent years they have been applied also for more complex products [17]. We think that these models would be useful also for the ETO companies because their principle is to make the technical knowledge of the engineer explicit to the rest of organizations, easing the workload of engineering department, as principle actor in the quotation process of the ETO companies.

2.2 Overview of Integrated IT Solutions and Their Impacts

From considerations highlighted in previous paragraph, it emerges that the need of integration between the marketing/sales and manufacturing represents a good field to implementation of integrated IT solution, as Enterprise Resource Planning (ERP).

The ERP solutions, complex and integrated cross-functional systems, can help to coordinate several activities, generating information in real time to support the decision processes, and simultaneously improving the quality of operations, human resources and accounting [23]. It is evident that the technology is only one aspect in the ERP, because it is not possible to implement an ERP without considering the other aspects, in particular these ones refer to people and processes.

In fact the implementation of an ERP can be influenced by several factors, especially of organizational nature like the suitable training and education, the implementation team (the program managers), the top management commitment, the fit between the ERP system and organization [24–27]: The success or failure of the ERP system can be linked to all these factors.

According to these considerations we believe that the analysis of every IT solution cannot ignore its managerial, organizational and accounting impacts, because these impacts may affect the achievement of goals of the IT solution itself [28–30].

Many contributions highlight the managerial impacts, linking the ERP implementation to a business process reengineering, because they often require to redesign the key business processes and to align their activities [31–33]. In this way it is possible to create value oriented supply chain, removing non value activities, cutting lead times, driving waste and costs away from the organization.

The managerial impacts are also linked to a better information flow and its effectiveness (in terms of timeless, transparency, efficiency, clarity, correctness and diffusion), improving the decision making process [34] and reducing time and costs for data collection and distribution. These benefits can be easier realized with a profitable relationship between the ERP and the business intelligence system [35, 36].

The presence of the information seamless flow throughout the organization can create a strong relationship between the managerial and organizational impacts, because it can determine a decentralization of decisional power among people at different levels, who have easier access to ERP system [37, 38], often uncovering underlying informal organizational structures.

According to literature, the ERP implementation is highly linked to organizational aspects, related both the structure and people. There is, in fact, a bidirectional relationship between the organizational structure and information system [39] and, in the specific case of ERP, the organizational structure is the starting point of every implementation process, also through the business reengineering process [40] and the job redesign [41].

The new IT solutions, indeed, impact on the skill and on the job description because the ERP improves the definition of responsibilities and segregation of duties, but sometimes the ERP implementation can change the nature of users job: in this way the job can acquire a collaborative nature and the interdependences among users can be increased [42]. According to the changes, it is necessary a training of users in order to acquire technical operational skills, cross-functional problem-solving skills, and an understanding of task interdependence [43, 44]. From this learning process it is possible to derive two key organizational impacts of social nature, connected with each other. The first one is related to the individual level: Users acceptance of the new IT solution, increasing the confidence and motivation in using the IT application and minimizing possible phenomenon of obstructionism [45–47]. The latter is related to the collective level: Enhancement of organizational culture, based on sharing, understanding and transparency information, which leads to a commitment to the system itself and the business goals [48, 49].

Other contributions consider the relationship between ERP and management accountants, highlighting the fact that the ERP, or the Information Technology in general, and the management accounting system are considered co-dependent [50]. In particular, some authors analyze the accounting impacts due to the ERP implementation [51]. Even if some researchers find that ERP systems have little impacts on accounting [52–54], others suggest that the management accountant can play an important role of business consultant in the ERP implementation [55, 56]. After the ERP implementation, management accountants have more time to

develop new knowledge in financial accounting and new skills to manage complex system. Besides ERP generates a great quantity of information which accountants can use in order to better understand the whole firm supporting decision making process [51]. Some researchers emphasize, in particular, the relevance of a successful implementation of an IS solution and its relationship with the management accountants role. Indeed, authors find that under a useful and successful ERP, management accountants can enrich their activities, as they have more time to do other. Instead if the ERP has some deficiencies, the authors argue that the accountants have to increase their tasks in order to support the problems created by the IS application [57].

For this reason the utilization of an ERP in a firm can shift the role of accountants from processing information (“bean counter”) to analysis, even if their responsibility cannot change due to an ERP implementation [54, 58, 59].

Operative changes in management accountants due to the ERP can be divided in two categories: Direct effects (as report content, timing and scheduling) and indirect ones (as changes in management practices and changes in business process) [51].

With reference to the first kind of impacts (direct ones), some authors underline that the IT solution is able to automatically produce reports, streamlining the accountants work and increasing the timeliness of information dissemination [60].

Regarding the indirect impacts, the most common ones can be expressed as the introduction of an internal audit function, the use of non-financial performance indicators and profitability analysis at segmental/product level [61].

3 The Research Question

The examined literature focuses on the impacts of the ERP in general context without considering specific manufacturing systems: most of the contributions refer to the ERP in large organizations and more recently to small/medium enterprises [40, 59, 62–64]. Few contributions focus on the implementation of integrated IT solutions in the ETO business [13].

The features of an ETO system, above described, and in particular the lack of products standardization makes difficult to implement and to utilize a generic information system, as shown in many contributions that highlight the failure of the manufacturing resource planning (MRP) production control system to effectively manage an ETO system [13, 14, 65–67].

Uncertainty, dynamics and complexity of ETO systems make inapplicable the information systems based on the features of the more standardized manufacturing systems, like make to stock [13].

From previous considerations it emerges that in the ETO companies the quotation phase is the most pivotal one. We believe that the implementation of the integrated IT solution in this crucial phase can bring significant advantages, especially in reducing:

- Lead time for a new tender;
- Errors in new specifications (as they are based on the specifications made in the old process);
- Engineering workload.

According to the literature, there are only few proposals to manage and to reengineer the quotation process [17] and thus to facilitate the engineering role in order to realize the necessary integration between sales and manufacturing.

Based on these considerations, an ETO system requires an integrated information system, able to manage a high number of engineering changes and cost variance to original estimates. It is necessary that this IS application is project driven and focused on production scheduling, but we believe that, in particular for large companies, the implementation of this solution is more necessary but also more complex because of high numbers of tenders and orders simultaneously managed, geographical distribution and organizational complexity [68].

We thus individuate a lack in the literature that regards the way to manage the typical features of an ETO firm (with especially reference to a large organization) through an integrated IS solution.

The aim of our work is to highlight the possibility of an integrated IT solution within an ETO company to manage the quotation phase and to facilitate the engineers work. In this way, we attempt to evaluate if uncertainty and complexity, specific features of the ETO, are better managed, in particular in a ETO-MC, characterized by high customization, products with high technology-content, complex processes, and multiple business dimensions.

To develop findings from our research we propose the following research question:

RQ: How is it possible to better manage, through an integrated multi-layer information system, uncertainty and complexity in the context of ETO-MC, also highlighting managerial, organizational and accounting impacts of the IS solution?

4 Research Methodology

In order to answer the RQ, the analysis is conducted through a qualitative case study methodology [69–73], as ETO literature demonstrates dominance of conceptual and case study approaches [1].

We chose this methodology because, in accordance with literature, the case study research is largely used in the area of information system. Besides, it allows the researchers to answer both “how” and “why” questions, in order to understand complex processes. Finally case study is appropriate method to research in any area in which few previous studies have been carried out and when boundaries between phenomenon and context are not clearly evident [74]. Furthermore other

academic authors argue that single case study is appropriate, if it proves to be a revelatory case, or it is critical or finally extreme or unique [71].

This qualitative approach is, thus, relevant to explore emerging lines of enquiry in order to build theories [75]. The research method can involve several instruments as evidences from fieldwork, archival records, verbal reports, observations and above all unstructured or semi-structured interviews.

For this work, we propose an illustrative and exploratory single case study that has the aim to illustrate new innovative practices, which can be considered particularly advanced. Besides this method allows the researchers to answer the research question in a single firm as preliminary and pilot investigation [71].

The exploratory single case study is therefore useful in our research, because it allows us to highlight first emerging lines of research, as our goal is to attempt to understand how the gap in the literature can be overcome.

This approach can, thus, prepare field for future researches also using different methods, analyzing wider population of large organizations in order to understand if the results of our single case study can be replicated in other companies with the same business features.

In order to reach the aim of our work, we examined a case from electromechanical multinational industry operating in engineer-to-order business (ETO-MC), characterized by high degree of complexity and uncertainty, depending on the nature of the large business and by multi-layer organizational structure.

Our case study is relevant because this large firm attempted to implement an integrated IS solution in order to manage the whole value chain and in particular the quotation phase, reducing its complexity and uncertainty.

In operative terms, the data was collected through empirical observations and focused interviews [76]. Moreover, one researcher was involved in daily activities of the examined case study, managing the implementation process of the IS solution.

The research design is articulated in three main steps: In the first one, we attempted to understand main features, functionality and innovation of the IS solution implemented by examined case; in the second step we investigated, in a critical perspective, main strength and weakness points, from different standpoints. Finally at the third phase, we highlighted the managerial, organizational and accounting impacts of the IS solution in order to answer the research question.

To this end, semi-structured interviews were conducted with professionals from the examined firm. In particular, we selected those people, who are been deeply involved in the utilization of this integrated multi-layer information system. We therefore submitted the same semi-structured questionnaire to different users: Financial Controller, Marketing and Sales and Engineering staff.

The questionnaire has the aim to understand the following key aspects:

- The role and the responsibility of the interviewees;
- Their activities before and after the IS solution implementation;
- Their perceptions about the IS solution (including advantages and disadvantages);

- The existence of training courses and other actions supporting the IS application;
- The managerial, organizational and accounting impacts of the IS solution.

After conducting the interviews, we elaborated answers in order to reach the aim of our work.

5 Empirical Research

5.1 Case Study: Engineer-to-Order Multinational Company

Case study is based on a multinational industrial group, which operates in engineer to order sector. The group has a presence in more than 100 countries and has about 150.000 employees with turnover of ca. USD 50 billion. It is organized in many Business Units (BU), which are multinational organizations characterized by specific product, market and technology. They report to Divisions, focused on providing products and solutions to homogeneous segments of customers/applications.

Group designs, manufactures and sells a wide range of high technology-content products and services, conceived for minimizing environmental impact, improving reliable and efficient availability of energy, and increasing productivity of own customers.

Group is listed on major stock exchanges in USA and Europe. It is featured by highly dynamic culture, strong focus on ethics and compliance, and commitment to follow market evolution and provide advanced technical solutions.

In particular we analyzed a specific BU, which produces electromechanical products and provides services for both industrial and utility final applications for key markets. This BU weights about 20,000 employees with turnover of ca. USD 6 billion.

This BU presents specific features linked to the heterogeneity of staff and markets, which require management of practical aspects like time zones, variety of education and culture of staff, languages, and further geographical variables. All these aspects must be considered in conceiving, developing and deploying IS solutions built on layers of global applications.

The analyzed BU is located in an organizational structure of this ETO-MC, called Division, which is very complex. The context becomes even more articulated, because this controlling Division is responsible for global sales for multiple BUs, additionally to chosen BU.

In this particular structure, several organizational entities have to be considered from applications standpoints with operational and managerial reflections. Firstly Division, industrially organized in Business Units, defines multiple layers, in order to face dimensional challenges (local versus multinational) and create synergies between main functional areas (Marketing and Sales in the Countries, Product Marketing and Engineering in the Business Units).

The organizational structure of the examined ETO-MC can be articulated as follows:

- Business Units are multinational organizations, responsible for given products range and markets through given manufacturing assets Feeder Factory Units (FFU). Business Units are also responsible to provide adequate IS applications to own FFU;
- Feeder Factory Units are national organizations managed by specific Business Units, responsible for design, manufacturing and sales of products in the range of their BU. FFUs are users of those IS applications, conceived by own BU for supporting their business processes;
- Global Sales Organization (GSO) is a multinational organization, responsible for sales operations, through the local branches, in individual national markets. GSO is responsible for overall sales for all Business Units and provides adequate IS applications to own Country Sales Units;
- Country Sales Units (CSU) are national organizations, responsible for sales of the whole product range of all Business Units, with commercial scope limited to customers in own Country. Country Sales Units are users of those IS applications, conceived by GSO for supporting their business process.

The Fig. 1 provides an example of such organization, where a complex and integrated IS platform may apply. BUs are independent, with separated profit and loss accounts, and report to Division. CSUs are also similarly independent and report to GSO, then to same Division as Business Units, for their investment plans and overall strategies.

This leads to necessity to integrate layers of global IS solutions, which are conceived and developed by each independent global entity (Business Units and GSO), but must be kept aligned and coordinated in development, implementation and scope, in order to maintain an adequate level of efficiency and effectiveness. In the analyzed case, the aim of integration is achieved by clear interfaces, adequate training programs and IS organizations, both global and local, which support their respective operations.

In particular, each BU is responsible to define, budget, build and deploy own IS applications, but they must have proper interface and operability and be compatible with IS applications defined, budgeted, built and deployed by GSO.

According to highlighted features of the ETO-MC (as analyzed in the previous paragraphs), general global mission of this integrated organization can be summarized as follows: *to quote the right product at the right price and time, from the right manufacturing location, through an efficient tendering process, carried out in the shortest possible time frame with best costs estimate.*

This mission is valid as general objective of any ETO business, but the multinational, multi-layer and complex nature of examined case make pursuit of this mission more challenging than in a small firm with limited number of operations in one or few countries.

FEEDER FACTORIES		GLOBAL SALES ORGANIZATION	CUSTOMERS COUNTRY
BU No.4	FF 4.1	CSU 1	CUSTOMERS COUNTRY 1
	FF 4.2	CSU 2	CUSTOMERS COUNTRY 2
	FF 4.3	CSU 3	CUSTOMERS COUNTRY 3
BU No.3	FF 3.1	CSU 4	CUSTOMERS COUNTRY 4
	FF 3.2	CSU 5	CUSTOMERS COUNTRY 5
	FF 3.3	CSU 6	CUSTOMERS COUNTRY 6
BU No.2	FF 2.1	CSU 7	CUSTOMERS COUNTRY 7
	FF 2.2	CSU 8	CUSTOMERS COUNTRY 8
	FF 2.3	CSU 9	CUSTOMERS COUNTRY 9
BU No.1	FF 1.1	CSU 10	CUSTOMERS COUNTRY 10
	FF 1.2	CSU 11	CUSTOMERS COUNTRY 11
	FF 1.3	CSU 12	CUSTOMERS COUNTRY 12

Fig. 1 Description of the multi-layer organization

5.2 Description of IS Application

In order to achieve the business mission, this layered divisional organization needs efficient solutions for collecting market requirements (from customers to each CSU), conveying these requirements (from each CSU to FFU or units) and preparing and delivering, back to market (from individual FFU, or multiple units, through CSU to customers), the most appropriate product proposal with characteristics, both commercial and performances, which meet customer’s expectations.

The current solution replaces a former architecture based on highly diversified range of custom applications developed during the years without an unified vision.

In the following, reference will be made to the examined BU even if CSUs serve multiple BUs, so actual complexity is higher.

For the scope of this chapter, the overall IS architecture (as referred to one BU only) can be described as follows:

- Front End Application (FEA): Global and common to all CSUs, for capturing their local market requirements. FEA is globally used by GSO for selling all products in the range of all BUs belonging to the same Division. Users of FEA are in each CSU, i.e. local Marketing and Sales organizations in different national market;
- Mid Layer Application (MLA): Global and common to all FFUs in each distinct BU, used for processing market requirements, collected through FEA, and translating them into executable for product definition and costing carried out by Engineering in FFU. Definition of MLA is under responsibility of Product

Marketing (global level) of each BU, and users belong to Product Marketing organizations (factory level) in each FFU;

- Back End Application (BEA): Global and common to all FFUs in each BU, for validation of product requirements (e.g. design, costing and delivery time), and overall validation of deliverables, to be offered back to customers with precise features and delivery time (confirmed by Manufacturing). BEA is under responsibility of Engineering (global level) of each BU, and users belong to Engineering (factory level) in each FFU.

This IS architecture is summarized in Fig. 2, which applies to each and every Country of previous picture, and shows example of four Business Units with relevant MLA and BEA. In order to make the tendering process fast, efficient and reliable, there is a need to create a business database, which collects both commercial (like customer, country, channel, price, margin, etc.) and technical (like voltage, power, size, etc.) data.

This business data must be transferred back and forth seamlessly, instantly, with one clearly identified entry point. Data can be made available and accessible along the process and around the world as needed.

For instance, M and S user—from CSU in Italy—may receive a request for certain products from an Italian customer. CSU (Italy) user will capture in FEA this requirement, for the given project (e.g. a new power plant) and, by clicking a button, will send request for quotation to a colleague sitting, for example, in France in a specific FFU in charge to make these products and assigned to support Italian market.

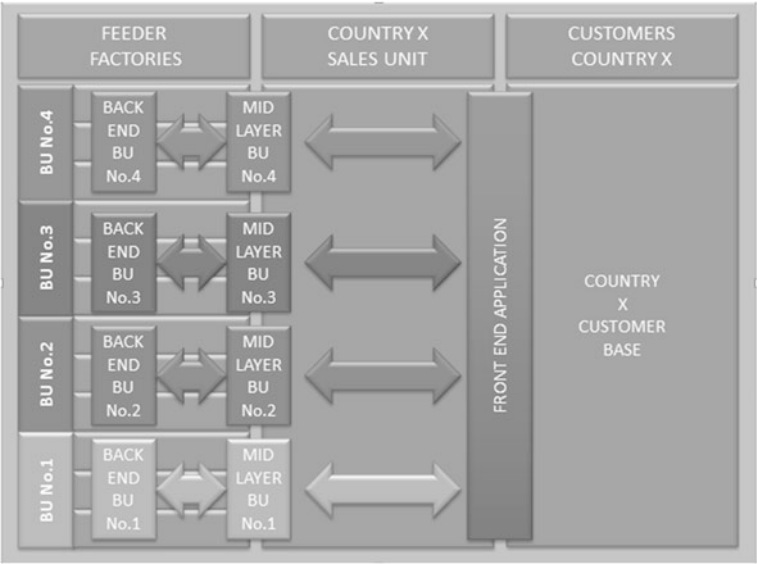


Fig. 2 Description of the IS architecture

Product Marketing (FFU, France) user will load automatically data in MLA from FEA and he will review information, validate and complete requirement, and will start the preparation of the tender for colleague in Italy.

At this stage of tendering process, Product Marketing (FFU, France) will first check if this solution is already available in BEA database.

In affirmative case, costs will be automatically refreshed by calling update of cost drivers, in order to verify if available solution, in addition to full technical compliance, is also matching profitability expectations against expected market price.

If solution is not available in BEA database, or costs of existing solutions are not fitting market expectations, the Product Marketing (FFU, France) will send—by pushing a button—request to Engineering (FFU, France) to design brand new solution, or re-design existing products. MLA will ensure availability of proper fields where additional input (for instance expected final cost of products to be quoted) can be also provided to Engineering by Product Marketing.

In this way, in case of necessity for re-design, or brand new design, Engineering (FFU, France) will receive automatically all necessary data in BEA and it will process a new/revised design, which will be made available in BEA database, for enabling Product Marketing (FFU, France) to continue the quotation process in MLA, before transferring back to FEA for benefit of CSU (Italy) user.

This process applies also when scope of supply may engage multiple Feeder Factory Units. In this circumstance, one entry point in FEA by Italian CSU will deliver the same commercial information (customer and project name) to multiple factories, using MLA and BEA. For example, data will be sent for quotation to FFU in France and FFU in the United Kingdom.

This architecture prevents error and improves overall end-to-end process quality, because it avoids re-typing of a large quantity of data, which is a non-value added activity. Additionally, it avoids involvement of Engineering unless the tender really needs it (for example when the project presents new items, which are not available in the database).

The process shown in the Fig. 3 describes when Engineering is involved.

Synthetically, the examined IS model has highlighted three layers (CSUs, Product Marketing and Engineering at FFU), which are supported in their daily activities by three distinct integrated global applications (FEA, MLA and BEA).

These distinct interfaced applications are designed in order to meet expectations of their respective community of users, and communicate back and forth from market to factory.

Indeed information flows, seamlessly, across FEA (in direct contact with Customers) to BEA (where Engineering designs the product), through MLA (where Product Marketing at Feeder Factory translates market requirements into data which Engineering elaborates as needed).

6 Empirical Results

6.1 Weakness and Strength Points of the IS Application

Based on the complexity of this IS solution, and on the several users involved in it, we considered necessary to analyze different perspectives of key people involved in development and utilization of this system.

In this way we attempt to understand strengths and weaknesses of this integrated global IS platform.

In terms of standpoints, main differentiation can be noted among direct and indirect users of these IS layers; the direct users are the Engineering (FFU), Product Marketing (FFU) and Marketing and Sales (CSO), while the indirect one is Finance and Administration at any level of the organization.

In order to analyze strengths and weaknesses, we chose as key functional areas Finance and Administration, Marketing and Sales (in this category both CSUs and Product Marketing) and Engineering.

Scope of Finance and Administration is to support top management in decision making process based on financial facts and on estimates as reliable as possible. This is achieved by supplying the management with reports and forecasts with financial KPI. As long as the quotation process is concerned, Finance and Administration is responsible to ensure correct and updated values for key factors affecting cost of production, profitability and finance (i.e. overhead cost factors, cost of financing, cost of insurance, etc.,).

Marketing and Sales, both Country and Factory organization, is responsible to manage the customers and to understand what are the best options for satisfying both markets and company's expectations. This function has to provide quotations, which have to be fast, complete and competitive.

Finally the responsibility of Engineering is to provide adequate technical solutions, which fulfill Marketing and Sales requirements, in line with factory capabilities, while streamlining design and costs. In ETO, Engineering is pivotal as both competitive pressure and profitability expectations can only be satisfied through careful product offering, which remains in the scope of this function (Table 1).

A more detailed analysis of conducted interviews has highlighted the key advantages, both operational and strategic, inherent to the integrated IS platform implementation and the database resulting from it. They can be summarized as follows:

- Use of knowledge-database (built on historical information about past projects and originated from units located in different geographical areas) accelerates tendering process, as this database becomes starting point of each quotation, and may avoid the necessity to involve Engineering through the whole process shown in Fig. 3 (timeline may be reduced from weeks to minutes);

Table 1 Main strength points of the IS application

Finance and administration	Key data about Marketing and Sales performance are accessed directly and in real time, without asking data owners (Product Marketing), except for validation (when formal communication must be provided to financial institutions and markets). These data are more reliable (because of segregation of responsibility and data ownership) and allow forecasting based on actual tendering activity (data results from each and every individual inputs carried out by CSO and Factory Product Marketing). Before implementation of the platform, the single source was the Product Marketing Manager, ultimate responsible for sales performance. Through the use of this platform, F and A is involved only for special tenders, when special assumptions make sense for cost estimates
Marketing and sales	In their daily work, M and S (CSU) can easily collect requirements from domestic markets and deliver them instantly to any FFU for evaluation and preparation of tenders. Local language can be maintained, as IS applications may offer graphical user interface properly translated in any language Downstream the value chain, M and S (FFU) can instantly verify if requirements can be fulfilled by using existing design from knowledge-database, or whether it is needed to send to Engineering request to prepare new cost/design proposals All M and S units have one common data warehouse where documentation is collected, stored and accessible by everyone, in line with own functional prerogatives. This facilitates sharing of information without restrictions, as long as access to Virtual Private Network is granted
Engineering	Knowledge-database is available to M and S for quick quotation. This reduces work load of Engineering, because it is not engaged for those quotations, which do not have high probability of success, or require special care for any business reason (for instance large tenders when special assumptions make sense for cost estimates) Knowledge-database created by Engineering in a given FFU may be shared with any other FFU, which is going to design a similar product. This option may completely avoid new design, or just reduce the effort, avoiding new design to be executed from scratch Free Engineering resources may focus on cost optimization for target tenders and orders, which are already acquired

- Commercial information in this database (e.g. quantity of products, tendered volume with price, profitability and expected award dates) allow to generate forecasts on demand for both financial and manufacturing needs, from any location in the world, as long as this web access is connected to Virtual Private Network of this ETO-MC;
- Improved timeliness in elaboration and diffusion of information, enabling better integration between engineering and marketing units;
- Increased efficiency in the use of information, avoiding redundancy, duplication and misalignment of accounting and technical data;
- Increased controllability and reliability of data.

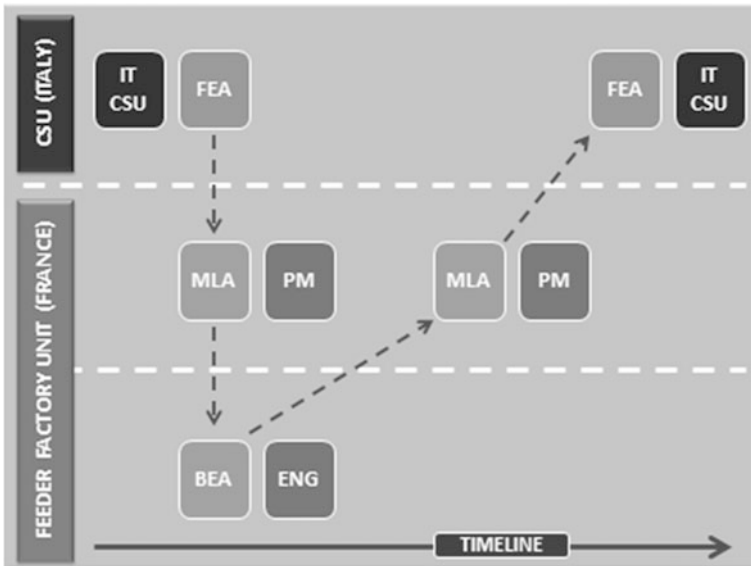


Fig. 3 Example of information flow with engagement of Engineering

Starting from these considerations, it emerges the extreme complexity and crucial role of Engineering, according to the literature. It represents a natural bottleneck to whole ETO-MC business processes, as role of Engineering covers the following activities: tendering of new design, validation of existing designs and optimization of designs before they are ready to move to Manufacturing.

Interviews conducted to Engineering show that in this multinational and multi-layer company, before this IS solution implementation, the load on engineering resources was dramatically higher in order to perform all the activities relating to both tendering and manufacturing phases across whole end-to-end value chain.

Without IS application, and if additional resources in Engineering are not available, in this ETO-MC there were often queues and delays even for delivering simply updates, confirmation of costs, or validation of existing designs.

In the worst situation, simple cost/design reviews took a period comparable to what is needed for a brand new design.

Integrated global IS solution implementation affects the crucial role of the Engineering, decreasing its workload. In particular this IS solution allows, through seamless connection between BEA and MLA, to fully by-pass Engineering for the following activities:

- Budget quotations or re-quote of existing products (just by using designs already validated and properly stored in BEA for search on demand);
- Automatic re-calculation of costs, by updating on-demand latest cost drivers from BEA into MLA (ERP systems play a fundamental role in supporting all these processes);

- Configuration of new products, by utilizing engineering rules programmed in MLA (with validation and maintenance of such rules by Engineering).

However, it is clear that the Engineering keeps its crucial role when, because of customers' requirements or corporate expectations, it is necessary to partially re-design, or newly design, a product, which would be otherwise not acceptable due to performance and/or costs.

Some considerations may be conducted about the weaknesses of this IS solution.

In fact, the overall effect of this integration, in an ideal IS platform, is to make new quotations, or their revision, in a matter of minutes instead of weeks.

Examining the weakness points (see Table 2) it emerges that there are some exogenous and endogenous factors that could hinder the achievement of the business objective.

The endogenous factors have mainly organizational nature; in particular some of them are linked to the business nature and organizational structure (complexity of processes and performance, depending on synergic co-operation of layered functions, are often driven by different management, with potential misalignment of priorities and objectives) and to the size of organization (number of units and

Table 2 Main weakness points of the IS application

Finance and Administration	Transparency combined with poor process implementation in the tool can lead to unnecessary clarification with top management, when orders are registered by CSO without validation from the factory. To this extent, the introduction of simple enhancements in the tool, like "double signature" feature may eliminate the inconvenience. In absence of "double signature" in the IS platform, it is possible, for instance, to have order cancellation, or orders moving from one month to another
Marketing and Sales	Users resist change and this is amplified if FEA and MLA are not properly conceived, developed and tested before deployment in field. Often, M and S utilizes local applications which are highly customized, and fit local expectations, in disregard of global requirements (set by GSO or BU) Hard top-down approach in deployment of the new solution achieves efficiency from IS standpoint, but may leave behind up and running the legacy applications, whose existence is not emerged and not properly addressed during the deployment. Under this situation, local M and S users often use in parallel new (global) and old (local) platforms, undermining in this way expectations of improved productivity
Engineering	Users resist change, and this is amplified if BEAs are poorly defined, developed and tested before deployment in field. Often, Engineering utilizes local applications which are highly customized, and fit local expectations, in disregard of global requirements (set by BU) Risk of having critical information lost across the process of moving data across different layers. Theoretically, this may happen because of incomplete description of product features implemented during development/implementation of IS application

their geographical location), while others are connected to characteristics of people involved in the firm. The first type can decrease the effectiveness of the information flow, increasing the probability of generating erroneous data and determining a lack of timeliness. The second type relates to cases of obstruction, that are physiological in each changes of information system, especially when they are not accompanied by adequate measures of communication, acceptance and sharing, and their benefits often remain potentiality, only appreciated by designers.

The exogenous factors are connected to the natural dynamics of markets, that can impose continuous changes due to, for example, different and increased requirements of the customers. These factors may require new data and features to be developed, and continuous adjustment in the information and activities of the overall value chain.

This leads unavoidably to gaps between what is needed and what is actually delivered through global IS architecture, as defined in the initial scope.

These gaps could grow with time in absence of careful and continuous monitoring, conjugated with evaluation of costs/benefits, related to the option of possible upgrade. In fact, a general objective of every project should be the one to grant adequate economic advantages in order to reduce possible gaps, and have a clear net convenience.

In the examined case study, limits can be functional (i.e. certain operations are not possible in seamless integrated environment) and/or conceptual (e.g. gaps can impair the capability of IS integrated platform to collect and/or deliver business intelligence data, which could be potentially obtained). In any case, either functional or conceptual, whenever there are gaps, this platform is failing to deliver a feature of value to the business.

6.2 Managerial, Organizational and Accounting Impacts

According to the literature, the integrated IT solutions are not only technical applications, but they also affect the whole organization, involving people, accounting and process areas.

From interviews, it is possible to highlight the main managerial, organizational and accounting impacts, which can support the decision to implement this integrated global IS platform. In Table 3, we classify the impacts in different types, even if we are aware that this division represents a theoretical forcing, because in reality the same variable can affect multiple areas. In particular in this context we consider as managerial impacts those regarding the process and the value chain in order to obtain competitive advantages. The organizational impacts are considered those that affect the organizational structure (responsibility, role and function) and the behaviors and reactions of people due to the IT implementation. Finally we consider the accounting impacts those that are relating to the production

Table 3 Managerial, organizational and accounting impacts of the IS application

Managerial impacts	Organizational Impacts	Accounting Impacts
A better use of resources (both physical and intangible assets) across tendering process (improved focus on value-added activities)	A better definition of responsibilities during tendering process, through proper segregation duties, by means of appropriate data entry points (who is in charge of what)	Real time global access to profitability data, based on actual tendering and order volumes, at any degree of detail
A better responsiveness by means of direct real-time access to technical and cost data for tendering (Engineering involved on demand only when strictly needed)	A better measure of workload at individual and sub-organizational level, by tracking the tender process and its relevant owners	Global benchmarking, both horizontally (comparison between CSUs, or FFUs) and vertically (CSUs-FFUs), in order to identify and establish best practices and organizational model
Better understanding of market size and business potentiality through structured collection of tendering data (one centralized global data warehouse with tendering and order data with any needed degree of granularity, both technical and commercial) in order to take the decisions for the market share	Increased transparency through sharing of business data according to common templates and definitions. Elimination of reporting efforts for Marketing and Sales, as all data may be available for each and every product quoted through the integrated platform	Forecast (profitability and order volume) based on actual data, not subject to filtering carried out locally by CSU, or by FFUs (data are by-product of tendering activities)

information regarding financial aspects and operational data supporting the control and decision making processes.

The different impacts are so highly integrated that it was difficult to qualify them accurately. In fact, for example, the use of different graphical user interfaces can have jointly managerial, organizational and accounting impacts. These interfaces may improve segregation of duties, which affect organizational efficiency, require a top stream analysis of the tendering process, optimizing the activities (eliminating or reviewing those with low value added) and finally they are also reflected in the accounting area, because they allow to improve costing and timing, to reduce errors and, therefore, to increase competition on the market.

7 Conclusive Considerations

7.1 Discussion of Empirical Evidence

After analyzing advantages, disadvantages and specific impacts of the integrated IT solution in our case study, it is possible to appreciate its potentialities in order to solve some key problems of the ETO-MC, while attempting to answer our research question. Further to results of the case study, we try to create a general model to optimize the implementation process of IT solution and to highlight, in a systematic way, the different types of impacts before described.

Concerning the first part of the research question (*How is it possible to better manage, through an integrated multi-layer information system, uncertainty and complexity in the context of ETO-MC*) we found that the ERP solution implemented in the examined ETO-MC has decreased complexity and uncertainty of the multinational firm.

With reference to the complexity, in the examined case, we found that it is mainly referred to the business and dimensional nature; the first feature (business one) determines the necessity to manage different kinds of information like bills of materials with many items, customer orders, work orders, control of non-physical processes, etc. The dimensional one refers to the existence of multi-layer functions and management, with potential misalignment between priorities and objectives. Besides the dimensional nature relating to multinational requires the cooperation among many operational units, located in several countries with different languages, cultures, currencies, time zones, etc. We believe that the potentialities of the IT solution must be appreciated in this specific and complex context, characterized by multilayer, multinational and large size.

Indeed, this IT solution introduces standard language that reduces the degree of complexity, helping communication and coordination among different countries and units. This standard language is realized through easily understandable graphical user interfaces which contribute to define procedures, separation duties and to assure the accuracy, timeliness and sharing of data.

We argue that examined IT solution brings a further contribution in order to reduce complexity, especially in ETO firms with high-technology content products and solutions. We refer to the necessity to integrate Engineering and Marketing and Sales functional areas, in order to satisfy efficiently and timeliness the customers' requests.

In particular, the IT application is able to realize this integration, which allows to reduce the workload of the Engineers otherwise hardly involved in the quotation phase and to avoid the bottlenecks and the other problems highlighted by the literature, increasing, in this way, the efficiency of the whole value chain.

Considering the reduction of the uncertainty we found that it is especially caused by the IT solution that is able to create a knowledge database with historical information referring past projects. In this way the uncertainty decreases because it is possible to make the technical and commercial data explicit to the

organization and to use sure and tested information to forecast future characteristics of projects.

Indeed, the database allows to facilitate the quotation phase and to generate forecasts on demand for both financial and manufacturing needs, from any location in the world.

Concerning the latter part of the research question (*highlighting managerial, organizational and accounting impacts of the IS solution*), we firstly analyzed principle features of the examined IT solution, underlining its strength and weakness points, and after that, from these considerations, we analyzed its three kinds of impacts, before mentioned.

The implementation of any global integrated IT platform generates potential advantages, which can be realized, influencing different leverages which interact each other. In particular we believe, according to literature, that the effectiveness of any IT solution is related not only to its technical capabilities but also to the actions and reactions of users.

In order to fully understand the impacts of global integrated IS platforms, its potential advantages and limitations, we attempted to identify the main leverages that interact and affect the effectiveness of the solution, how shown in picture below attached (Fig. 4).

According to the literature, in order to systematize impacts emerging from the case study we attempted to propose a general model for optimizing the IT solution implementation. We argue that actual economic value of every IS-supported process, especially if this process is sustained by multi-layer architecture on global scale organizations, can depend on growing degrees of three leverages, which can

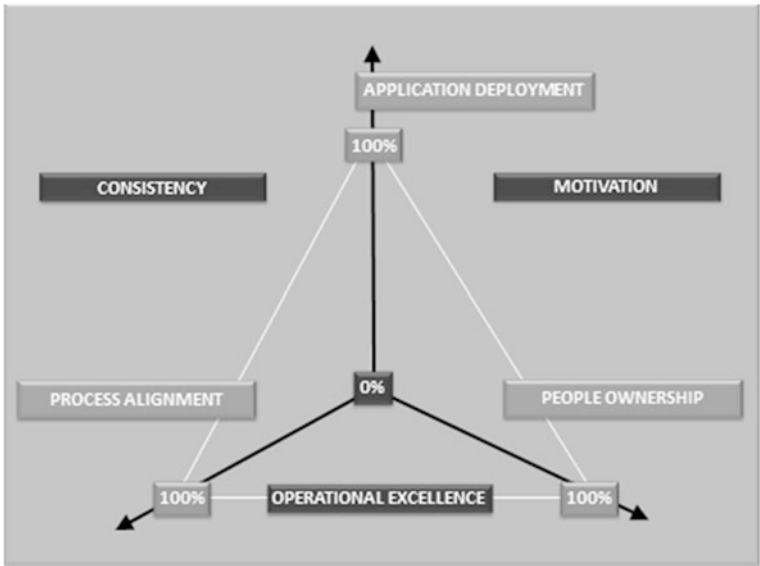


Fig. 4 Leverages of advantages of the IS architecture

be defined Application Deployment, Process Alignment and People Ownership. They are defined in the following way:

- **Application Deployment** refers to satisfaction of IT functionalities, with respect of requests agreed between Program Manager and own business stakeholders. This agreed scope may prove to be, in the worst cases, completely unfit to actual business needs for several users: This leads to next variable;
- **Process Alignment** refers to the gap between what users have to do and what IT platform enables them to do. There is full alignment if IT application provides full coverage and it allows to the users in charge to do the right action. In examined case, it would not be sufficient, for example, to have availability of design to be submitted to customers, if information is validated by other users than Engineering;
- **People Ownership** refers to the way in which IT platform is understood and accepted. This can be monitored, for example, verifying full phase out of legacy applications and applying proper improvement measures (for instance by monitoring the ratio between items created with the new IS platform and total items).
- Any variable is represented in an axis of the figure (Fig. 4) and each plan (between two axis of these leverages) may help in representing impacts on managerial and organizational domains. Indeed these plans signify drivers of **Consistency** (overall matching between what IT application delivers and what is actually requested), **Motivation** (willingness to use IT application by users) and **Operational Excellence** (users' satisfaction due to quality of their processes, as the IS application should support them in their activities).

The three mentioned plans represent together the managerial and organizational impacts, because they highlight the possibility to improve the process management both with appropriate technical and operational solutions (application deployment and process alignment) and organizational solutions (people ownership).

In this way, the proposed model seems to not take into account the accounting impacts, but, considering the high integration among the three aspects, we think that accounting ones can be represented in the space created by the managerial and organizational plans, like consequential and synthetic aspects. Specifically the accounting impacts can be represented by the volume which is contained within the pyramid defined by connecting points representing level reached on each axis. The accounting space can be easily related to the business KPIs of profitability.

The more IS platform fits with actual organizational needs and managerial goals, the more this results in improved speed, completeness and accuracy of quotation.

In any firm and particularly in the quotation phase of an ETO-MC, as the examined case, the accounting impacts (more directly than the managerial and organizational ones) can be referred to internal and external perspectives.

The accounting impacts, from internal perspective, are related in particular to the productivity increase. The IS platform will enable ETO-MC to evaluate, for a

given customer/tender/product, the following aspects: the choice of the most suitable factories, through overall optimization; the use of assets, manufacturing loading, costs and delivery time. These combined effects potentially decrease costs and propose more competitive prices, without reducing the profitability.

This could also affect the external perspective, in fact customers of the ETO-MC, with this IT application, could perceive offer as more valuable than competitors and they could be willing to pay premium prices or just award more orders to this organization.

Besides the IS solution seems to influence some strategic aspects, because, in this way, it is possible, in real time, to process a lot of operational activities and to provide to the top management information about which markets and products to develop, which investments to make and which strategy to apply in order to help the making decision process.

In the light of these considerations, we found that the examined IT solution, implemented in ETO business and in large and multinational context, presents several potentialities. Among these, the most important one is the possibility to create a cumulative knowledge data-base, that can be represented as an historical memory of the firm and besides it can produce new knowledge, creating added value. This also facilitates continuous learning process in different levels and areas of organization and provides access on demand and real-time to these cognitive resources, sharing information, which are generally in the hands of few specific people. In this way, in our case, the knowledge about the technical aspects is shared among the different functional areas involved in the quotation process, not only in the hands of the engineers. For this reason, it is realized the main advantage by-passing the critical role of the Engineering and facilitating the integration between Engineering and Marketing and Sales.

Finally in order to reach the aim of this work, the proposed figure (Fig. 4) allows us to highlight the significant considerations about the actual effectiveness of the examined IT solution.

In our case study the IT solution is endorsed by top management in order to establish global processes, to create, in this way, conditions for easy adjustments of organizational set up and to follow, or even anticipate, market evolutions. According to the literature, the sponsorship by the top management is a pivotal factor for the success of every IT solution, but we think that it is true only if this sponsorship is accomplished with the correct use of the leverages before mentioned. From the conducted analysis, it seems that in the examined company not every leverages are used. In particular from the review of the weakness points it emerges a low use of the organizational leverage related to the ownership people. In fact, the implementation of any IT solution must be related to human resource management: the best technical solution can be a failure if it is not accomplished with the appropriate action of communication, training and sharing that can generate acceptance among involved people.

7.2 Suggestions for Further Researches

Authors individuate at least two future research developments around this matter. The first stream could progress researches within same examined case. In this context it could be interesting to conduct a longitudinal study, in order to analyze if phenomenon of learning is verified, while testing also increased commitment of employees involved in the tendering process. The second stream could concern the possibility to test the empirical results of this work in larger scale studies.

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IS to Support Project Management: Implications for Managerial Accounting

Giuseppina Iacoviello and Arianna Lazzini

Abstract Information technology (IT) is used as a tool to reduce some of the problems generated by fragmentation typical of project management (PM). The use of IT improves coordination and collaboration leading to better communication practices. Nowadays PM, due to the high level of complexity which characterizes the context in which firms operate, requires a concrete information system and suitable managerial accounting. Such tools are basic to support project-managers in the decision making process and aiding performance evaluation. The aim of this chapter is to analyze the relationship between PM, information systems and managerial accounting from a theoretical and pragmatic perspective. An input–output model will be used to clarify and analyze the correlation between managerial activities and firm performance. The managerial implications of a set of methods and techniques suitable to manage a project in its different aspects and phases will be emphasized.

Keywords Information systems • Managerial accounting • Project management

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1 Introduction

Information systems (IS) are of basic importance in managerial daily activity. The first use of IS in business was in relation to accounting and in particular in management accounting [1]. Management information systems (MIS) are systems using formalized procedures to provide management at all levels in all functions with appropriate information based on data from different sources (internal and external). Management information systems enable managers to make timely and effective decisions for planning, directing and controlling the activities for which they are responsible [2]. Applying these concepts to project management we can define a Project Management Information System (PMIS) as system tools and techniques used in project management to deliver, collect, combine and distribute information through electronic and manual means. Project Management Information System (PMIS) helps plan, execute and close project management goals. The attention given by scholars of business administration on managerial accounting topics has privileged the study of process-costing reserving only a marginal attention to job-order accounting typical of project management.

The result is that currently few studies and researches, both at national and international level, are aimed to analyze the specificities of such realities. Project Management's topics have become, by contrast a primary field of study and research of other scientific fields, first of all of engineering. This lack of focus can be considered a relevant gap in accounting research because of the significant specificity in terms both of planning and control systems and of information systems which characterize these businesses.

On the basis of these premises the aim of this chapter is to highlight the relationships between information systems, management accounting and project management. For each dimension we will analyze the tools and techniques suitable to manage the different phases in which a project can be articulated.

2 Theoretical Background

The study of the main relationships between management accounting and information systems in job-order business require, first of all, to focus attention on two different but interrelated topics: project management information systems and job-order accounting.

Project management information system (PMIS) has been defined [3] as a system which supports and facilitates the managers to manage the different phases of projects characterized by complexity, subject to uncertainty, under the pressures of market, with time constraints and money. One of the most important functions of a PMIS is then to provide managers with essential information on the cost-time-quality performance parameters of a project and on the interrelationship between them [4]. In project management the role played by information technology (IT) is critical. Information technology has become a concrete tool to improve

management information systems [5–8] reducing some of the potential problems generated by fragmentation typical of projects. Studies and researches [9–13] demonstrated that IT can improve coordination and collaboration leading to better communication practices. Its benefits include: an increase in the quality of documents produced, more efficiency and efficacy in economic and financial controls, an easier communication process and a simpler and faster access to data as well as a decrease in errors.

Information technology plays a central role in project management because of the three critical and interrelated dimensions to manage each project: time, cost and quality. A concrete and suitable information system and a valid data warehouse are critical to support managers in the daily decision making process and into performance evaluation (Fig. 1).

A data warehouse is a database designed for queries and analysis. It contains historical data derived from transaction data and other sources and enables organizations to consolidate data from several sources (Fig. 2). A suitable data warehouse enables the creation of an unique and comprehensive source of information common to the entire organization. The data accumulated during time becomes a real corporate asset to be used in long-term strategic decisions or short-term and tactical decisions [14]. A data warehouse can support managers in the trade-off between cost-time-quality.

A data warehouse is typically the source of information required for decision support systems (DSS). An important role of a decision support system is to make available information for users to analyze situations and make decisions more effectively [15].

A central component of the broader concept of decision support systems is represented by management accounting.

The role played by managerial accounting has become progressively more and more important for the high level of complexity that characterizes the current context in which firms operate.

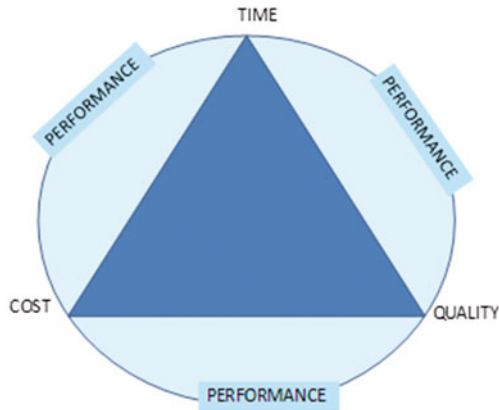


Fig. 1 The performance triangle in project management

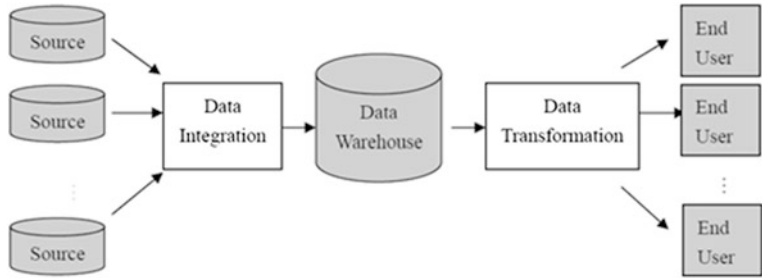


Fig. 2 A data warehouse

Management accounting is relevant to link time, costs, and quality, the three main dimensions to analyze to evaluate project management performance [16]. In other words it can be considered a critical mechanism to manage a project (Fig. 3).

Project management processes are divided into five sub-processes: initiating, planning, controlling, executing and closing [17]. Each phase is linked to each other by the results they produce. The core process groups: planning, executing and controlling shape management accounting. Each process is characterized by inputs, tools and techniques and outputs.

The planning and control processes are of critical importance to a project. They can be articulated into different phases. The planning process is composed of: scope planning, scope definition, activity definition, resource planning, cost budgeting, project plan development.

Critical for the proper planning of a project is its breakdown into elemental parts or blocks (work packages). This division coincides with a Work Breakdown Structure (WBS) activity [18]. This decomposition into blocks or elementary parts, also called “Means-Ends Analysis”, facilitates the planning process and the related cost analysis and control, supporting the subsequent phase of variance analysis. Another benefit from WBS is the ability to connect each block to the

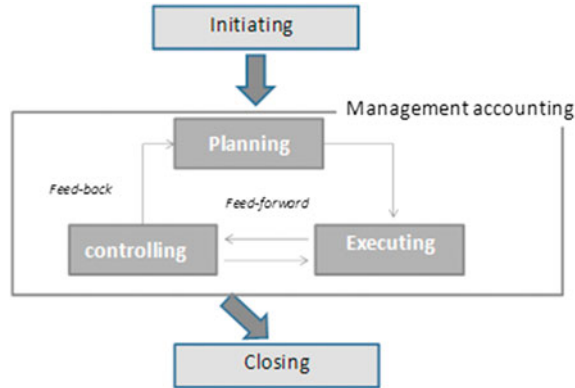


Fig. 3 Management accounting to support project management process

organizational structure defining both the unit responsible for each operation of the project and the time necessary to perform it. The process of allocation of responsibilities allows also a cross check of the financial costs and other economic variables.

The control process is basic to measure regularly project performance identifying possible variances from plan in terms of time and costs. The control process can be articulated into two phases: performance reporting and overall change control.

To ensure an effective process and an efficient use of resources managers require to employ software. Software to support managers in the different stages of planning and control process becomes indispensable. Managers require tools and services that enable them to an efficient and effective governance of each projects with particular attention to time and costs. In this sense services of content management, workflow and business intelligence are becoming essential to manage a project lifecycle. An unified process to manage projects is also essential to align resources and investments toward business priorities and analyze performances using dashboards.

3 Methodology

To understand the role and application of information systems in project management we have chosen to use an intensive strategy of research: an in-depth study of reality.

The case study methodology [19] is an interesting empirical approach to study a complex and contemporary phenomenon that evolves over time. Past studies [20] suggest methods to help researchers conduct rigorous analysis of these kinds of studies.

The case study is an intensive strategy of research that utilizes multiple information sources, both qualitative and quantitative. The case study allows researchers to investigate and to understand present and past dynamics through individual or multiple scenarios within the same research design. The case study using techniques typical of quantitative approaches, allows the researcher to test hypotheses formulated [21].

The case study can be used in researches design with different scopes. It can be useful in exploratory studies for the construction of new theoretical constructs, such as in other projects to offer support to an existing theory or to highlight existing gaps.

To explore and understand the project management processes and tools we deliberately chose to limit our study to a single enterprise that met exact criteria directly related to what we refer to as a successful project management business.

The businesses chosen operates in a particular sector: information technology and services. This case is particular interesting for our scope because it integrates project management with advanced tools and techniques in information systems.

4 Case Study

- Avient Solutions Group;
- Mauro Cappuccio, President and CEO—owns 100 %;
- Location: Toronto, Canada Area;
- Industry: Information Technology and Services;
- Employees: 60;
- Revenue and private: \$10,000,000.

Avient Solutions Group, founded in 2004, is in four global locations (Toronto, Chicago, Pune and Mumbai); the group develops a detailed Enterprise Information Technology Assessment for the client, encompassing the entire organization and its business units.

In analyzing data resulting from review of the business plans, organizational design and leadership, financial performance, technology infrastructure, delivery and support model, maintenance and service agreements, and interviews with key personnel, Avient is able to document the “As Is” state.

By applying Avient’s extensive and unbiased knowledge of IT infrastructure and services several new opportunities are identified to help the customer progress toward their short term goals. In addition to providing assessment reports and associated artifacts, Avient developed a methodology for the client to perform self-assessments and maintain currency of the report. Particularly, Avient Managed solutions include infrastructure, applications, security, business intelligence and:

- Security Solutions;
- Data Protection Services;
- Storage Services;
- Vulnerability Management;
- Incident Monitoring and Response;
- Logging and Archiving;
- Messaging Solutions;
- Virtual Desktop Services;
- Remote Desktop Management;
- Desk Side Support.

The Engagement and Project Management method is the foundation underlying the processes of all work performed by our consultants and is our method for the way we do business.

When used in conjunction with the sales and account management method and the appropriate service line method (life cycle or route map), the consulting teams have an efficient and effective process for successful service delivery. Since every project is unique to some degree, the practices described in this method need to be applied sensibly with the concurrence of both client and engagement leadership. The Engagement and Project Management method is based on a number of important concepts that makes it very practical to use in the day-to-day life of the Project Manager:

Distinction between managerial and technical control—it does not contain the delivery actions that must be carried out to build and implement the desired end product. It only relates to those actions in the sense that it provides a way to estimate, plan and monitor them.

Use of a scalable approach: no one management approach suits all types of engagements.

Problem and risk management: An effective management process seeks to predict and reduce the probability of variance before it occurs, and to have carefully designed contingency plans for the inevitable disruptions.

Focus on a team approach: As for all problem-solving approaches, team aspects are an integral part of effective engagement and project management.

Client involvement: Many projects face issues that are beyond their control. It is therefore extremely important to set up an appropriate steering committee that will be presented with these issues, alternative solutions and evaluation of impact on the project schedule, resources and deliverables, the composition of this steering committee will vary depending on the situation and the potential impact of the system to be implemented.

Use of a project repository: Throughout the method, the emphasis is on the integration of the information required by all parties involved. The Project Repository gives a unified structure to classify all deliverables handled during the project management process.

Real-time project management: Modern project management must be workable in very dynamic environments. This can be achieved only if the method is easy to consult and apply. The method has therefore been designed to provide a broad range of navigation possibilities (through events, streams and deliverables).

5 Discussion

Avient needed enterprise project management solutions but found them too sophisticated for its needs. It selected Microsoft Project Professional 2010 as its desktop project management solution. For back-end collaboration, it chose Microsoft SharePoint Server 2010, Microsoft Exchange Server, and Microsoft Office to manage The “Enterprise Technology Assessment”. Project Professional 2010 integrated with SharePoint Server 2010 provides a structured workplace for launching projects, sharing information, and managing projects using graphical reports and dashboards.

It is an essential contribution in making the difference between project success and project failure. Therefore, it is fundamental to the attainment of consistent client satisfaction for engagements conducted under a firm. The customer can also view selected information, and have up-to-the minute status/visibility as to project milestones, issues, risks, cost-budget run rate, and related information.

For example, when a client identifies an opportunity for which it will need consulting assistance, the client will know and often authorize a feasibility study to

decide if it should undertake the larger program. The engagement life cycle definition will determine whether the feasibility study is treated as the first phase of the potential larger engagement or as a separate, stand-alone project. It must be made perfectly clear that the application of the Project Management method needs to be carried out with intelligence by trained and experienced Project Managers, since this method describes a “normal” situation and every project has its own particularities.

Information systems could support the growth of client; the Project manager provides the client the ability to align IT to the business: a cost effective and timely approach to ensure continued alignment with the business of information, people, processes and technology.

6 Conclusions

Engagements and projects within engagements are unique undertakings. Consequently, they all involve a degree of uncertainty. Project processes are performed by people and generally fall into major categories. A process can be defined as a series of actions bringing about a result. At a minimum, project phases should include some variation of the Phases of Start-up, Execute and Run-down. Collectively, the engagement and project phases are known as the engagement and project life cycle. It's obvious that information technology is used as a concrete tool to reduce some of the potential problems generated by fragmentation typical of projects management (Processes and Process Interactions). Within the Project Management method, roles and responsibilities could be described at the activity level using a table—as in Avient—that show who is Responsible, Accountable, Consulted, Informed, who Verifies, and who must approve with a formal Sign-off. There are many ramifications to the decision. If treated as the first phase of a larger engagement, different decisions are made regarding staffing, leadership, infrastructure, and even work location, than would occur if were perceived as a stand-alone smaller project. The Project Manager is driven by events that occur during the on-going management of the project. These events trigger a series of stages, which aim to produce a number of deliverables, through a series of activities. When an event occurs, the Project Manager selects the appropriate event in the method and reviews the associated stages and activities to decide on what is necessary to respond to the event; the use of IT can improve: coordination and collaboration leading to better communication practices. The combination of software has proven to be a very powerful enabler and allows instant communications and project visibility for all stakeholders.

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Putting IS and Organizational Change into Context: The *Pros* and *Cons* in Kibernetes

Daniela Rupo

Abstract Based upon the framework of integrated information systems, this chapter aims to investigate the linkage between organizational evolution and the development of the infrastructure for management accounting in a specific context. The chapter analyses how the management accounting system is implemented, and the main strengths and weaknesses of the adopted solution, within Kibernetes RC, a software house belonging to a leading Italian group focused on public agencies. The software house has been committed in the last 2 years to the internal development of a specific management accounting system to drive the change from a small entity based on a centralized decision making model toward a medium-sized organization based on empowerment and delegation. Though findings deriving from the case study cannot be generalized, they provide insights in relation to the suitability of IS to achieve desirable effects of economic performance and social change within the organization.

Keywords Accounting information systems (AIS) • Management accounting • Organizational change • Integrated information systems • Case study

1 Introduction

Studies on management accounting and integrated information systems (IIS) have developed across a wide range of research streams. As emerges from the literature review conducted by Rom and Rhode in 2007 [1], some research streams

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emphasize the information system side, while other research streams emphasize the management accounting side. Some branches of research are, instead, focused on the relationship between IIS and management accounting.

With reference to the aforementioned relationship, many studies consider IIS as the independent variable, and management accounting as the dependent variable, then assuming the existence of a unidirectional relationship, where the IIS is expected to impact or support the adoption and the evolution of management accounting techniques. The reverse relationship between management accounting and IIS would also be relevant to investigate. This reverse relation seems to be more significant in the long term, given the difficulty in changing the ERP system in the short term, but it can be relevant in the implementation phase too, or even beforehand, if we consider that management accounting techniques can change IIS.

Another relevant issue in this argument refers to what seems to be the key characteristic of IIS: integration. The information system is structured to take a comprehensive view of all the areas of activity in order to provide coordinated responses to problem solving, at the different levels of the organization.

Some authors have identified three dimensions of integration: data integration, hard/software integration and information integration. Data integration refers to storage and maintenance of data in the same place, hardware/software integration is about network connectivity, while information integration is about the interchange of information between different organizational units and refers to the coordination of information for different purposes (i.e. reporting vs control use) [1, 2].

Empirical studies have investigated the effects of the degree of integration associated with IIS, highlighting that sometimes ERP systems lead to an excessive degree of integration [3]. As argued by authoritative doctrine [4], integration must not be strived for at the sacrifice of management accounting, and, especially in the pilot phase, information systems that are not fully integrated can meet the needs of management accounting better than fully integrated ones.

With regard to the implementation phase, as pointed out by Chrisanthi [5], it is of crucial importance that information systems (IS) research and practice associate technology innovation with the context within which it is embedded. The suitable degree of integration and the main level of integration (data, hard/software, information integration), likewise the type of artifact designed to implement the control system, ought to be assessed with specific consideration of certain contextual variables. For a non-comprehensive illustrative purpose, it is worth considering:

- *The evolution of information needs related to the firm's stage.* In literature different models of organizational life cycles have been proposed, in an attempt to explain the changing characteristics of organizations over time. In these studies the formalization of control and the degree of integration of the IS are often associated with the stage of the firm [6]. Even when explaining the evolution of management accounting systems, time is a relevant variable: Cooper and Kaplan [4] propose a four-stage model of cost systems design in which the information system must pass through a phase of disintegration before it can finally be integrated. So, the evolution of information needs depends on the

firm's stage and the implementation of control systems requires a process of adaptation which is related to an increasing level of integration;

- *The style of leadership underlying the control system design:* the relation between the leadership style and the level of delegation is a significant issue in designing control systems. Literature shows empirical evidence that if lower-managers have little autonomy in the operation of their unit, there is less benefit in interacting with top management [7]. The benefit of integration, in such a situation is poor, the need for integration of information systems (hence of management accounting systems) is moderate. Thus, there is a positive relationship between the choice of delegation and empowerment of subordinates and the benefits of integration;
- *The management accounting tasks and techniques:* IISs are designed in relation to the management accounting task and technique. The level of automation in the collection of data is influenced by the nature of the management tools the company intends to implement: empirical studies have shown that companies adopting the balanced scorecard prefer to collect data manually, and that ERP systems seem to be more effective with regard to transaction process and less effective with regard to reporting and decision support [1]. Therefore, the development of IIS is driven by the development of management accounting tasks and techniques;
- *The individual capabilities of users and their participation in the design of AISs.* Among the characteristics influencing the effectiveness of the IS, flexibility, functionality, user-friendliness and level of effort needed to implement the system are those primarily related to the individual attitudes and knowledge of users, i.e. to their capabilities. Furthermore, the involvement of users in the design of AISs is deemed to be a factor having an influence on the successful design and implementation of new ISs. Users' participation helps them to accept change, by increasing the consensus of the organizational members and reducing the risk of dissonance between IS functions and organizational structure. The benefits of users' participation on management accounting system performance seems to be more consistent when task uncertainty is higher [8].

As outlined in the cited literature review [1], current research on the relationship between IIS and management accounting is primarily based on the survey method. Only a couple of studies apply field study methods, while in-depth case studies are absent on this topic (up to the date of the cited content analysis), though, in order to support the investigation of the relationship between management accounting and IIS, more in-depth case studies and large scale surveys would be desirable. Moreover, a more recent literature review confirms the lack of case studies on this topic [9].

To explore the micro-level foundations of these domains, an in-depth analysis has been conducted in a software house, Kibernetes RC, which is part of a leading Italian group focused on Public Administration agencies. The company has been

committed in the last 2 years to the internal development of a specific management accounting system to drive the change from a small entity based on a centralized decision making model toward a medium-sized organization based on empowerment and delegation.

Using the case-study method, among the suggested approaches for qualitative inductive field analysis [10], the chapter points out the pros and cons of the management accounting system designed in the context under study.

After the short description of the theoretical framework and the definition of the research proposal, given in this section, the chapter proceeds as follows. The next section describes the research setting and methods. [Section 3](#) analyzes why our focal firm developed the IS. [Section 4](#) analyzes how the new process was developed and the main specific features of the management accounting system in the context under study. [Section 5](#) discusses the findings and concludes.

2 Research Design and Setting

The study is based on the case-study method, followed by the identification of several elements favoring the coupling of theoretical framework and practical application of management accounting systems.

The research setting is the confluence of AIS and management decision making, in the context of the evolution of organizational architecture from small-sized entrepreneurial management toward a medium-sized company experimenting delegation process.

The focal firm was chosen because it allows an intensive examination of the setting and supports a better understanding of how management accounting systems can be implemented within an SME. The firm provides the researcher with a two-fold perspective of analysis: (a) it represents, in some respects, a typical case, being a suitable context in which to verify several theoretical issues outlined above, and (b) at the same time it holds an intrinsic interest that made the case essentially unique, because of specific variables which enable the firm to overcome most of the critical challenges generally encountered by firms in the process of implementation of a new IS.

Using data from semi-structured interviews made previously by the author during the 2008–2011 period, and archival and secondary materials as well, the chapter illustrates the unexpected but explainable nature of IS design that leads users to perceive their role in the new organizational architecture, and is effective in supporting management decision making.

3 Kibernetes RC at the Turning Point of its Growth

The creation of “Kibernetes RC” dates back to 1994, when it was founded as “Computer Center Calabria”. The company provides public agencies with software solutions and consultancy. More specifically, the company delivers to local governments and health agencies: IT services and software; specific consultancy to support the financial area and, more generally, administrative and accounting functions; supporting and guiding legal compliance.

The business idea was conceived in partnership with entrepreneurs operating in Treviso, thus obtaining relevant synergies from their relative experiences, values, principles and models of business. At present, the “Kibernetes RC” is part of a leading group covering the entire peninsula, with companies in various regions of northern, central and southern Italy. Over the years, the Company has embarked on a path of change that led to reconfiguring the system of products / services offered and to redefining the boundaries of markets.

In an early phase, the company was involved in selling the software solutions produced by Computer Center in Treviso on the local market, providing the final users with technical installation, maintenance and/or assistance. Thanks to the availability of high capabilities for technological innovation, in recent years, the company has created its own business unit of software production, and delivers customized services to public agencies. At present, the software production for the entire Kibernetes group, which was previously concentrated in Treviso, is shifting gradually to the company operating in Calabria.

With regard to the dimensional parameters, Kibernetes RC falls under the category of small businesses. The average turnover of the last 3 years is around 2.5 million Euros and the number of employees is 30. Both of these dimensional parameters have recorded a significant upward trend over the last few years.

The current stage of the company’s life-cycle (known in literature as a stage of formalization), is characterized by the need for delegation and control, associated with the growing level of complexity and of dimensional parameters. In this stage the organization needs to adopt new success criteria in order to survive, including efficiency, control, planning, and so on, and therefore needs a change in structure and activities [6].

Previously, the Company’s structure was mostly informal, although some procedures were already emerging, as a consequence of the adoption of a “pseudo-functional” structure. In fact, each head of department had limited delegation in decision making, since planning and control were mainly carried out by the top manager (the founder of the company). Thus, the structure enabled economies of scales within functional departments, in-depth knowledge and skill development, but the level of empowerment and of horizontal coordination among departments was poor.

To face with the environmental changes and the growing dimensions of activities, the Company needed a more suitable structure. Among the available alternatives for structural design, an hybrid structure was preferred, which can offer greater flexibility in this phase (Fig. 1).

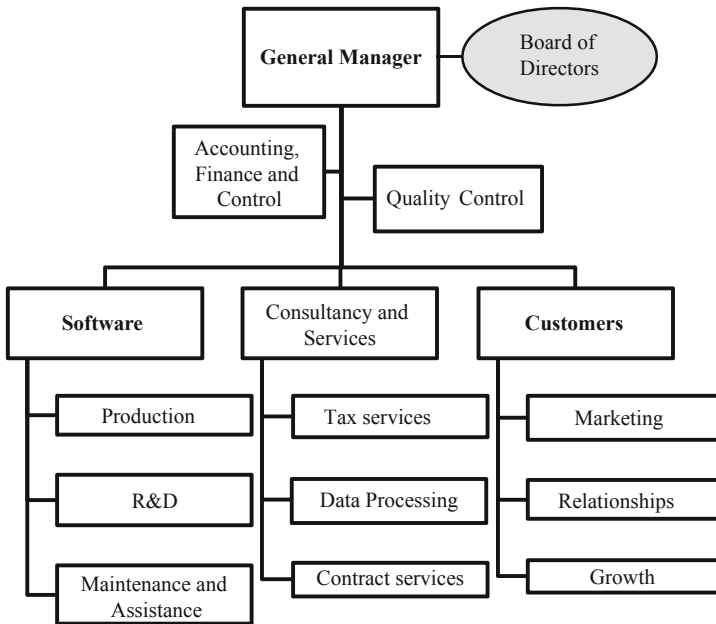


Fig. 1 The new organizational structure

The new organizational structure, which combines different organizational designs, the functional as well the divisional structures, encompasses two divisional departments (“Software” and “Consultancy and Services”) and a functional department (“Customers”). Specific staff positions have been assigned for “Accounting, Finance and Control” and “Quality Control”.

4 The Implementation of the Management Accounting System

The new management accounting system was designed in parallel to the implementation of a new software developed by the company. The software enables a relatively simple system of data gathering and information elaboration in order to support management needs with appropriate reports, meeting the requirements of reliability, timeliness and relevance of information, with regard to the specific information features of the control process (antecedent, concurrent and final).

The management accounting system, it is worth noting, was designed in line with the process of business process reengineering (BPR), which was carried out together with the design of the new organizational structure.

The software (named “MASK”, which stands for Management Accounting System Kibernetes) constitutes a technical tool which, on the one hand, allows the management of appointments and arranges the assignment of tasks in a structured way and, on the other hand, assists management in the coordination and control of the various activities (production and support). Thus, it is possible, for example, at any time, to check the progress of various orders, or locate the set of activities (events) which refer to a subject at a given time, or locate the contracts in progress with the same customer. Each process can be broken down into the stream of activities that compose it, and for each of them the following elements can be evaluated:

- The absorption of resources in terms of personnel costs and other inputs used specifically, and the indirect costs may be attributed to the contract;
- The gross margin, i.e. the value creation associated with the contract, in terms of unit revenue, if specified in the cost of the contract separately or as percentage of total revenue. In some cases, the mechanisms of output enhancement (formation of the prior contract) are not likely to single out a specific price for each activity, but are anchored to the value created for customers: for example, in recovery projects (activities aimed at recovery of VAT or local taxes by the central government) the benefit is determined on the percentage recovered. Similarly, the price of software products often includes training, assistance and maintenance, which are not necessarily valued separately in the offer.

The process of configuration of the various organizational variables was conducted through the participation of users. The management accounting system has been projected to support planning and control, likewise the measurement of performance, with regard to each business unit, each function, each position or group of people involved in a project. Coherently, the implementation of the new software will be completed after a period of pilot testing of the whole management accounting system.

5 Discussion and Conclusions

Managing IS projects during organizational change poses several challenges for a firm. The in-depth analysis conducted in Kibernetes RC enhances the comprehension of how a management accounting system can be implemented in a small business in the phase of growth, softening some critical behaviors of people closely interested in the new design of the organization, and enabling the performance of the IS.

The management accounting system as a whole, and the technical artifact show several strengths, including:

- MASK is not a standard software, to the technical specification of which the firm is bound to adapt the IS and the planning of activities: it is made according

to the specific requirements of the control system, in other words it is “customized”;

- The software is easy to use, flexible, user-friendly, the main capabilities needed are those related to manage a planner, but it allows managers to know instantaneously what, where and why each employee is doing, and address this information for control purposes. Thanks to the benefit of ERP systems, information storage enables multiple use of data, which is processed for measuring of costs, profit or loss, timeliness of each activity, budgeting and control;
- The designers of the management accounting system work inside the firm, and are those to whom the main aspects of the delegation process are addressed: their involvement can mitigate the risk of failure of the ongoing change;
- The level of integration, in this phase, is high as concerns the data, the hard/software interface, and the transaction process, while it is moderate for as concerns reporting and decision making. This is in line with the prediction of previous literature, and is more likely to assure flexibility of the control system in the phase of first implementation of the management accounting system. In this phase the management accounting system is the independent variable, the IS being the dependent variable.

Notwithstanding the aforementioned *pros* of the management accounting system designed by the focal firm, potential weaknesses (*cons*) are linked to other contextual variables, which may raise the risk of implementation failure:

- The informal nature of control, which up to now has characterized performance evaluation, and which could continue to be predominant even after the implementation of the new IS. As argued by Tywana [1], combining informal and formal control mechanisms can enhance the fulfillment of projects and objectives and the flexibility of the firm. Nevertheless, the risk of inadequate balance between formal and informal control could be the impairment of the management accounting system;
- The residual risk of dissonance between IS functions and organizational structure, due to the introduction of middle-management to implement the process of delegation by the entrepreneurial group, in response to the increasing environmental complexity and to the firm’s growth. The process of delegation is intended to lead to a deeper consciousness of the role each member has been attributed within the group, and to move toward desirable levels of empowerment and effectiveness. The cultural, social and cognitive forces of such a process are crucial to meet the goals of IS, thus the implementation of the new system requires a wide consensus and the active participation of all the employees, including those at the bottom level.

The contextualist approach suggested in this chapter provides a way of gaining insights into the explanation of the role attributed to IS innovation, with regards to the introduction of the management accounting system, in the phase of organizational change. The implementation of management accounting, supported by

ERP system, via the involvement of users, is expected to enable the effectiveness of delegation, and more rational coordination and control of people and activities.

Though findings deriving from the case study cannot be generalized, the intensive examination generated by the research suggests that such analysis is particularly relevant in order to design ISs capable of achieving desirable effects of economic performance and social change within the organization.

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Analysing Flexibility and Integration Needs in Budgeting IS Technologies

Wipawee Uppatumwichian

Abstract The duality characteristics of budgeting between the flexibility driven decision-making and the integration focused management control inspire the author to investigate how the flexibility and integration domains influence controllers' choices of IS technologies used in budgeting. This includes the enterprise resource planning (ERP) system, business intelligent (BI) and spreadsheets. Guided by the human agency concept, twenty-one controllers in eleven companies in Thailand are interviewed. The analysis shows that flexibility and integration in budgeting IS technologies can be viewed from four domains: organisation-in-focus, personal requirement, business requirement and reporting requirement. The analysis shows that there are conflicts between these four domains. It is found that spreadsheets are used when flexibility is needed. However, the ERP system and BI are employed to support integration. The major implication is that controllers apply several IS technologies to support budgeting because each IS technology is designed for its own respective purposes and intentions.

Keywords Budgeting • Decision-making • Management control • ERP system

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1 Introduction

Granlund [1] states that current accounting information system (AIS) research should focus more on management control and decision-making issues in connection to modern IS technologies. This is in agreement with Jones and Karsten [2] who feel that modern IS technologies like the enterprise resource planning (ERP) system may restrict users in business processes. Inspired by them the present paper aims to react to these two previous research gaps by investigating management control and decision-making in a budgeting context with a view to identifying how they enable and/or restrict business controller choices of IS technologies used.

Budgeting, as one of the oldest yet most popular accounting controls [3], is defined as a process undertaken to achieve a quantitative statement for a defined period of time [4]. A review of Simons' levers of control¹ [5] suggests that budgets can be used either diagnostically for management control purposes in order "to monitor organisational outcomes and correct deviations from pre-set standards" and/or interactively for decision-making so that managers "regularly and personally involve themselves in the decision activities of subordinates". Traditional budgeting literature often associates budgeting with management control [6]. Nonetheless recent literature has indicated that increasing numbers of organisations are turning to budgeting as a decision-making tool through an adoption of better budgeting practices [7] such as rolling forecast, due to rapid technology changes [8], local contingencies [9], and intense competition [10]. The author builds on Simons and postulates that it is up to top management to determine how these control mechanisms should be combined; therefore it is deemed that budgeting incorporates both management control and decision-making roles in varying combinations.

The dual roles of budgeting require the process to be more flexible, in response to local contingencies and intense competitions, yet more integrative for efficient monitoring [11]. The flexibility driven decision-making calls for a participative budgeting approach in order to collect diverse information, such as hard financial and soft intellectual information sources, for budget constructing at unit levels. On the contrary, the management control foundation calls for a company-wide integrative performance measurement mechanism, therefore department-specific budgets must be integrated into one solid organisational plan so that the management can verify goal congruence [12], whilst also monitoring and identifying performances.

Consistent with Granlund [1] and Scapens and Jazayeri [13], it is claimed that prior research on how IS technologies are used in management control, decision-

¹ The levers of controls is used in line with previous interpretations in budgeting research, namely Abernethy, M.A., Brownell, P.: The role of budgets in organizations facing strategic change: an exploratory study. *Accounting, Organizations and Society*. 24, 189–204 (1999). Therefore the author omits the two remaining control systems-boundary system and belief system- since they are not related to budgeting.

making and budgeting is limited. Previous research particularly concentrates on the ERP system, and claims that the ERP system changes the role of management accountants from bean counters to business partners. They spend more time and skills on information analysis due to improved relevant and real time information access provided by the system [14, 15]. Research has suggested that the ERP system as such does not have any direct impact on the financial or non-financial performance of organisations. Indeed the impacts are shown only when the ERP system is used to mediate proper management control techniques [11, 16]. Therefore, the ERP system adoption per se neither promotes an adoption of the advanced management accounting technique [17] nor changes the nature of budgeting ex-post [18, 19]. In a study where the ERP system and BI are compared [20], BI seems to have a slightly better support for budgeting than the ERP system. However the supports for budgeting from both systems are still non-significant. This results in spreadsheets being used as the primary tool in budgeting processes [21] in both multinational and local organisations despite the existence of ERP and BI applications. None of the aforementioned reports have provided an explanation as to why advanced IS technologies such as ERP and BI cannot defeat simple spreadsheets in budgeting processes. In the quest to unpack ERP's and BI's moderate impacts on budgeting, the author is convinced that it is crucial to uncover the nature of budgeting per se in relation to IS technologies. The author believes that budgeting portrays a brilliant social context under which to investigate the complex entanglement among management control, decision-making and IS technologies in response to the research gaps addressed above.

Having identified the nature of budgeting, the author dwells here on budgeting as a social conduct and turns to the human agency concept in Anthony Giddens' structuration theory (See Sect. 2) to interpret how business controllers (human agents) may understand control mechanisms embedded in budgeting through their choices of IS technologies such as ERP, BI and spreadsheets. Therefore the research question addressed in this paper is: how can the needs for flexibility and integration in budgeting IS technologies be explained?

This chapter proceeds as follows. In the next section, the concept of human agency from Anthony Giddens' Structuration theory is introduced. Section 3 discusses an interpretative case study method and describes the eleven case companies selected for this study. Section 4 provides vivid examples from the case companies and analysis on the flexibility and integration needs in IS technologies used in budgeting. Section 5, the final section, discusses research conclusions and implications.

2 Human Agency

This chapter employs structuration theory as a background to the analysis as the author focuses particularly on the human agency concept embedded in the theory. It is claimed that Giddens favours this approach over a vain application of the

structuration theory in its entirety because it allows more detailed and meaningful exploration of a problem at hand [22]. Following Giddens' advice [23], the concept of human agency is applied in this study as a sensitising device for data analysis rather than a prescribed guideline for data collection and analysis.

The structuration theory places emphasis on a process whereby human agents and society interact and create social structure. However, Giddens' view of human agency is strongly voluntaristic [2] compared to the society. Giddens argues that except in cases where human agents have been dragged and mishandled by others, they always "have the possibility to do otherwise" [24]. In other words, human agents have an ability to interpret how particular social structures enable or constrain them to achieve certain actions; consequently they attempt to work around these enabling and constraining powers, which might unintentionally generate change in the social structure.

Many writers have questioned whether or not social structures (be it physically or, as Giddens puts it, out of time and space) simply constrain human agents since there are many circumstances in which agents are 'forced' to pursue only one feasible option [25, 26]. In addition, Archer [27] further comments that the 'could-have-done-otherwise' human agency concept is problematic because it implies that human agents do not have to adhere to social structures in the structuration. In response to his critics, Giddens argues that everything else other than the human agency contributes to a form of determinism forcing those subject to it which implies his determination on the power that social structures have on human agents.

The author employs the concept of human agency in connection to previous works on IS [See for example: 28–30]. Especially from Orlikowski [29] who is clearly influenced by Giddens' human agency as she conceptualises material artefacts as "the outcome of coordinated human action and hence inherently social" being "created and changed by human action".

Budgeting is deemed to entail the flexibility and integrative requirements previously discussed. Through the interviews with business controllers (human agents), the author seeks to describe the needs for flexibility and integration in budgeting IS technologies and how these needs are interpreted in their choices of IS technologies employed. The next section discusses the research method and the case organisations involved in this study.

3 Research Method and Case Descriptions

This chapter adopts an interpretative case study method [31] based on the mutually dependent ensemble view [32] towards technology and social in line with the human agency concept rooted in structuration theory. Eleven for-profit companies from Thailand are included in this study based on the following criteria: (1) company which has installed and used ERP system for accounting and finance function for more than two years to ensure system maturity, (2) company which is

listed on a stock exchange market to ensure proper internal control compliance and size consistency, (3) company which has used budgeting as the main accounting control.

The data for the study are collected from many primary and secondary sources including face-to-face interviews with twenty-one participants in the eleven companies, internal documentation, annual reports, and company websites. The author conducts semi-structured interviews which last for an hour on average. All interviews are recorded, transcribed and analysed using Nvivo8 qualitative analysis software. The inductive coding technique [33] is adopted to guide the analysis. Coding is performed in two iterative steps; first an open-ended general etic coding followed by a more specific emic coding in order to allow a maximum interwoven within the data analysis. Interview participants are primarily middle managers, responsible for budgeting in the companies such as chief financial officer (CFO), accounting vice president, planning vice president, accounting policy vice president, financial analyst and IT manager. The choice to predominantly select middle managers is informed by established academic arguments on how these middle managers influence strategic and operational practices in organisations [34, 35].

The companies studied are located in Thailand; however they participate directly in the Global economies since they export goods and render services outside the country. Companies in the energy industry (Cases A, B and C) are the back bone of the Thai energy production chain which serves Thailand and the Asia Pacific region. Their activities include offshore oil drillings, oil refinery, petrochemical productions, power plants and gas stations. Companies in the food industry produce many internationally recognised food products. Cases (E and F) are Southeast Asian units of global food companies, while cases (D and G) are Thai-based food original equipment manufacturers (OEM) which supply products on a global scale. The remaining four cases (Case H, I, J and K) represent diverse industries, yet they are core functions of the country's economy. Case H is a Thai business unit of a worldwide automobile brand. Case I is a Thai OEM of automobile parts for many known personal car manufacturers. Case J is an international electronic organisation which specialises in household appliances. Case K, a division of a Thailand-based hospitality conglomerate, operates many five-star hotels, resorts and serviced apartments both domestically and internationally. Table 1 summarises company profiles and IS technologies used as they relate to the budgeting process.

All organisations have ERP systems and spreadsheets for budgeting but some have additional access to BI which is presented in two forms: off-the-shelf BI and own BI. The off-the-shelf BI refers to a situation when organisations adopt packaged BI available from vendors. This type of BI is referred straight in the paper by BI vendor names. The own BI refers to a situation when organisations internally develop their BI for budgeting in cooperation with IS/IT consultants. Cases B and K use Cognos and IDEaS BI applications for business forecasting. Case A is using the Magnitude BI to assist budgeting but is also configuring SAP ERP for cash flow budgeting. Case E is another case which uses Magnitude BI for budgeting; however the company is assessing the possibility of implementing an

Table 1 Case company descriptions

Case	Industry	Main activities	Owner	ERP	SSs	BI
A	Energy	Power plant	Thai	SAP	Excel	Magnitude
B	Energy	Oil and petrochemical	Thai	SAP	Excel	Cognos
C	Energy	Oil refinery	Thai	SAP	Excel	–
D	Food	Frozen food processor	Thai	SAP	Excel	–
E	Food	Drinks and dairy products	Foreign	SAP	Excel	Magnitude
F	Food	Drinks	Foreign	SAP	Excel	Own BI
G	Food	Agricultural products	Thai	BPCS	Excel	–
H	Automobile	Truck	Foreign	SAP	Excel	–
I	Automobile	Automobile parts	Thai	SAP	Excel	Own BI
J	Electronics	Electronic appliances	Foreign	JDE	Excel	Own BI
K	Hospitality	Hotels and apartments	Thai	Oracle	Excel	Ideas

SSs stand for spreadsheets

own BI on a global scale. Case G has experienced a failed Cognos BI implementation. Cases F, I and J have access to own BI solutions which are used to report their preformatted budgets and actual operating results to headquarters. Although some organisations, especially foreign-owned companies, may not have the full authority toward there IS/IT policies, the author is convinced that they have enough control over there IS/IT procedures as they can raise issues to their respective foreign headquarters.

4 Empirical Data and Analysis

This section disaggregates the empirical data and analysis into two sections. The author begins by analysing how business controllers, through IS technology use, interpret the needs for flexibility in budgeting IS technologies. The author then continues discussing the same matter with the integration of budgeting. The inductive coding and data analysis suggests that flexibility and integration can be considered from the following four dimensions: organisation-in-focus, personal requirement, business requirement and reporting requirement.

4.1 *Analysing the Needs for Flexibility*

The bottom up budgeting technique, adopted in response to rapid rates of technological advancement, intense competition, and market vitality, requires budgeting processes to differ from one individual unit to another due to environmental variations, specific company characters and prioritised objectives [8]. To improve decision quality and reduce uncertainty inherent in complex decision-making, businesses often employ various assumptions from diverse sources corresponding

to individual unit requirements as the Planning Vice President in Case B describes: “to construct a revenue budget, we look into assumptions such as GDP, field oil prices, Dubai oil prices and exchange rate. These things also vary from business unit to business unit. We have a special team working on these assumptions because they determine our revenue budget, hence our ability to predict sales peaks and bottoms”. The term flexibility used here refers to business controllers’ discretions over the use of a budgeting system for decision-making which gains its momentum from advanced IS technologies [36]. Spreadsheets and BI are famous examples of IS technologies which allow ad-hoc customisation of routine budgeting information, while the ERP system constantly enforces routine reporting for different recipients. Through the use of these IS technologies in budgeting, the author attempts to interpret what flexibility might mean to business controllers.

Organisation-in-focus—budgeting is constructed to reflect actual operation which might be different from legal entities used for financial statement preparation. With this in mind business controllers must therefore make certain adjustments for operational purposes as the Financial Planning Manager in case F explains: “planning is more complicated than the normal accounting procedure. Accounting department closes their books based on their legal entities, don’t they? Let’s say it is the legal entity for Thailand, so they close the book and pay taxes. Anyhow we have certain departments that do not work entirely for the Thailand legal entity like legal and IT departments, for planning purpose I must exclude them [using spreadsheets despite the existence of own BI system]”. Intricate separation between legal and operational entities has also caused Cognos BI implementation failure resulting in a sole reliance on spreadsheets for budgeting, as the Central Accounting Executive describes in Case G comments: “I never see how Cognos [BI] would work for us except in that case that we had one simple legal entity separated into departments. But we are a group of companies; we have many legal entities and many business lines. On occasion we have the same legal entity working on two separated business lines”. It is indicated that for planning and decision-making purposes, business controllers need to separate an operational view from an ordinary legal entity view using IS technologies, that is, spreadsheets which are most suitable for them.

Personal requirements—personal requirements and preferences characterise the use of IS technologies in budgeting, especially spreadsheets, as the CFO in case H exemplifies: “Excel [spreadsheets] are built based on a person’s experiences and preferences. Like when my selling and administrative (S&A) controller left the company, the new controller must learn how the old guy created formulas and links. It was a lot of work which lasted for a couple months. But in the end, he just gave up and created a new Excel sheet because he was not used to it. He was not familiar with the old formulas and patterns. It was just easier for him to create a new sheet”. In case G, the author has observed that a personal work requirement fuelled with championship plays a significant role in shaping flexibility beyond technology capabilities as the Senior Costing Manager in Case G points out: “Cognos [BI] can be used for simple budgeting. I mean if you want to get an

income statement and a cash flow statement. Fine, that is very easy to do. You can also put in simple assumptions and turn them around but I think our Senior Management Accounting Manager [who is primarily responsible for budgeting] wants ‘too much’ out of it. That is why it did not work”. It has been demonstrated that business controllers approach budgeting from diverse requirements beyond a capacity that any advanced IS technologies can offer; therefore they prefer to use spreadsheets because the technology allows them to exercise their personal discretions in budgeting.

Business requirements—Subunit business requirements and needs for locally unique information dictate how budgeting should be carried out at unit level. Business controllers often design the processes to reflect their business nature but often IS technologies which enforce routine reporting stand in their way. The Accounting Policy Vice President in case B indicates: “our businesses move very fast. We have non-oil businesses like coffee shop and space rental under one service station. SAP [ERP] does not have any function that will support these extra activities that we have for a service station, we want to report all business activities that happen. We want to drill down to see how much we are making from petrol, coffee shop and space rental for example. They all should be treated as segments under that service station but it is very complicated to design this into SAP [ERP]”. Ever-changing business environments and strategic compliance obligate budgeting practices to change accordingly but it is not always efficient to alter these requirements in the ERP system as the Head of Accounting in case A points out: “budgeting is not fixed like [financial] accounting. If we plan that we will acquire six more companies next year then we have to change SAP [ERP] codes, but we can do this very quickly on spreadsheets”. Even in the case that an IS technology is specifically designed and developed for company-specific budgeting practice, it represents incompatibility issues with company-owned business requirements. The Financial Planning Manager in case F, who has access to a home-grown budgeting BI (own BI), indicates: “we must share our revenues with our business partners according to certain specific agreements, which it is not an easy round number. Our [own BI] cannot support this revenue sharing requirement so we encourage our regional companies to continue using Excel [spreadsheets]”.

Reporting requirements—reporting represents a very important aspect of decision-making because it allows decision makers to check on progress and resource utilisation, detect problems and decide corrective actions. Therefore business controllers need to look for information from numerous dimensions, namely sales by customers, products and gross margin, based on their personal needs for information processing. Indeed, as the Financial Planning Manager in case F indicates: “my boss is rather creative, he always asks for new dimensions of information”. Spreadsheets are often the IS technology that business controllers turn to in order to generate reports because it is more practical, flexible and faster as the Accounting Policy Vice President in Case B which has access to both ERP and BI technologies suggests: “top management’s requirements come and go very fast. So we extract data from the SAP [ERP] and do it on Excel spreadsheets instead. [Apart from that], SAP [ERP] cannot generate reports that we want.

The system might have one report that we need but it does not have the other nine reports that we also need”. This statement is supported by another indication from the CFO in case H who confirms that she “hardly uses any reports coming out of SAP [ERP]” because they do not meet her simple reporting requirements. She further explains: “if I look at the actual results from SAP [ERP], it does not mean a thing to me. I need to compare the actual results with budget numbers but we do not have those on [SAP] R/3 [ERP]. After that I need to see variances, you know this kind of thing makes it hard to use any [SAP] R/3 [ERP] report”.

At present, the analysis shows that business controllers need flexibility for decision-making in budgeting. They focus on an operational view of organisation and allow their own individual approach to dominate budgeting practice in response to unique local business and reporting requirements they receive from top management. The next section proceeds to analyse the integration in budgeting using the same dimensions.

4.2 Analysing the Needs for Integration

The elementary function of management control, which is to compare performances against pre-determined standards and plans, calls for complete information integration across data sources. The term integration refers to standardisation of data definitions and structures using common conceptual schema across a collection of data sources with the assistance of IS technologies [37]. The ERP system, which exists in all case companies, is supposed to bridge information from diverse data sources. However, it seems to be of little assistance due to an incompatible design which fails to integrate the business and the system. This is evident when business controllers use Excel spreadsheets for many budgeting processes, namely budget consolidation and variance analysis, because the integrated ERP system is not compatible with work processes [18]. The most advanced use of the ERP system for data integration purpose is present in cases A and B where the ERP system is used for budget spending control in connection with procurement and accounting functions. The Planning Vice President in Case B explains: “from a workflow perspective, we link budgeting with purchasing. When we buy something, we indicate that it is bought for this budget line and this is the money we have got. Then we reserve the amount in SAP [ERP] so next time we know that this is the money we have left. When the transaction is completed, we use this information for general ledger recording”. This section attempts to interpret what the needs for integration might mean to business controllers in budgeting work.

Organisation-in-focus—The bureaucratic multi-divisional organisation structure calls for integrated information through existing IS technologies for financial monitoring. Although this work is supposed to be achieved through the ERP system, empirical evidence suggests the opposite as the CFO in case J expresses: “all companies (or the legal entities) in the Southeast Asia region use JDE [ERP]

but they are not interconnected so we use the [own BI] to report data instead". In every case where an own BI is present (Cases F, I and J), it is used solely for budget and/or actual data submission in compliance with group reporting policy, therefore it does not allow any complicated data manipulation needed for analysis. The remaining cases, including case B which seems to have the most advanced integrated IS from an integration of budgeting data on both ERP and BI, perform a partial budget consolidation on Excel spreadsheets. The Planning Vice President in case B explains: "the issue is that some of our affiliated companies (or the legal entities) are not yet ready for Cognos. So now we use Cognos for consolidation if we can. For those that are not ready, we get Excel sheets from them instead. Then we combine Cognos with Excel in order to get a consolidated statement for the entire group". This indicates that at the organisational level, the multi-divisional organisation focuses on integrated information based on a legal entity for business monitoring purposes. Many IS technologies are used for budget information integration, that is, BI with the assistance of spreadsheets. The ERP system, an integrated IS technology, is supposed to facilitate budget consolidation but the empirical evidence suggests otherwise.

Personal requirements—Common conceptual schema information is fundamental to management control because it allows business controllers to track performance against pre-set standards. IS technology enables common data definition across local units, therefore it works against personal data definitions and requirements [11]. Indeed, the Business Intelligent Manager in Case K expresses: "a consequence after the central database implementation is standardisation. Properties used to report whatever they wanted to because it did not affect anyone else, now they have to conform to a reporting standard". The positive impacts of a collective work approach, which relies on common data definition based on integrated IS technologies, are time discipline and information accuracy. First the Vice President of Information Technology in case I explains how an internally developed own BI can improve time discipline through discretionary reduction among business units: "the issue was that business units did not submit budgets on time so we implemented a[n] [own BI] [instead of spreadsheets]. Through [own BI], we can announce that we allow them to upload budgets until this day, and then we will close the system. It imposes time discipline on them". Second the Planning Vice President in Case B further mentions that information accuracy benefits from using integrated IS technologies: "when working with spreadsheets, there is no way to verify that the information is correct. When we use Cognos [BI], it is a whole new story. Now it is a system practice". From this the author deduces that the collective-work approach and IS technology alignment are not only essential to budget data integration but also generate many positive impacts to organisations as a whole.

Business requirements—The multi-divisional organisations establish enterprise-wide business requirements and performance goals for subunits which need to be monitored closely. In Case B, budgeting information is integrated from the BI to the ERP system for control purposes since the ERP system gives an easy and up-to-date comparison between actual spending versus budgets [14]. Integrative

advanced IS technologies help business controllers to monitor subunit performance as the Business Intelligent Manager in Case K discusses: “after we have implemented the BI and a central database depository, it is easier to work. Like when I want to plan a brand promotion, I do not have to call properties up anymore. I just log on to the system and see the trend”. Despite this she acknowledges that a lack of fully integrated budgeting information on one single IS depository is a hindrance as she further suggests: “since the actual performance is on Oracle [ERP] but the budget is not on there, somehow I feel that there is a lack of synchronisation between performance and budgets”. The results shown in this section are consistent with Chapman and Kihn [11] who conclude that IS integration enables control.

Reporting requirements—External financial statement reporting standards like generally accepted accounting principle (GAAP) or international financial reporting standards (IFRS) may have an impact on budgeting especially for listed companies because a management team must make performance commitments to a board of directors and shareholders based on a complied financial statement format. Integrated IS technologies reassure that business controllers conform to financial statement reporting standards. The Financial Analyst in Case B observes: “using Cognos [BI] is better for budget consolidation. Cognos [BI] follows GAAP but you can never be sure with Excel [spreadsheets]. I can track eliminations of intercompany transactions in Cognos [BI] which is not always possible to do in Excel [spreadsheets]”. A similar reason is evident in case A where IFRS compliance is the major drive behind their ERP system upgrade as the Treasurer comments: “we decided to upgrade to SAP [ERP] ECC 6.0 because of IFRS.² It will come in effect this year so we set the timeline that the upgrade had to finish before the year started”.

The analysis demonstrates the need for budgeting integration in management control by monitoring legal business entity through a collective approach in response to enterprise-wide and external reporting requirements. The author now presents the analysis conclusion with regards to flexibility and integration domains in budgeting as well as any possible future research.

5 Conclusions and Contributions

It can be concluded that budgeting works clearly combine the flexibility in decision-making and the integration in management control elements into the process. This statement is in line with the suggestion from Simons [5] that it is up to the management to make their own decisions in specific contexts on how these control

² The Federation of Accounting Professions (Thailand) plans to align the existing Thai accounting standards (TAS) with IFRS effective from 2011 onwards commencing with Thailand's fifty largest listed companies. (Source: www.fap.or.th).

Table 2 Contradictions between flexibility and integration in budgeting

Dimensions	Flexibility	Integration
Organisation-in-focus	Operational basis entity	Legal basis entity
Personal requirements	Individual requirements	Collective requirements
Business requirements	Local business requirements	Enterprise-wide business requirements
Reporting requirements	Individual reporting compliance	External reporting standard compliance

mechanisms should be combined. Through the concept of human agency building on the flexibility and integration use of budgeting, the author further analyses how business controllers interpret the entanglement of budgeting IS technologies, namely the ERP system, BI and spreadsheets, in connection to the flexibility and integration conditions. The analysis shows that business controllers perceive flexibility and integration from the four dimensions: organisation-in-focus, personal requirements, business requirements and reporting requirements. Table 2 summarises the findings based on the analysis of the empirical data from the eleven cases.

The first organisation-in-focus dimension demonstrates that there is a struggle between the operational and legal entity view of organisations. It is clear that both views are needed in a budgeting process, however, for contradictory purposes. The operational view assists local decision-making, dissimilar to the legal view for monitoring and control. This means that spreadsheets are often called upon to assist data manipulation based on the operational view while advanced IS technology like BI is often used for supporting budget consolidation according to the legal view. An interesting finding is that despite the existence of the ERP system in all case companies, none of the case companies use ERP for budget consolidation.

Regarding the personal requirements dimension, the author displays a contradiction between individual and collective requirements. Business controllers at local level often require distinctive information, structured around one’s personal requirements, preference and experiences, to support decision-making. Once again the findings show that spreadsheets are the main IS tool used to tailor data according to one’s requirements because it is not possible to retrieve this unique set of data from advanced IS technologies like the ERP system and BI. Indeed these technologies are designed and operated according to the collective requirements for data gathering across organisational units.

From the analysis of the business requirement dimension, it can be stated that it represents an incongruity between local business requirements and enterprise-wide business requirements. Business controllers comment that advanced IS technologies, especially the ERP system and BI restrict them to comply with local requirements. In order to react to the restrictions imposed, business controllers maintain their own separated spreadsheets suitable for business nature. On the contrary, they acknowledge the importance of integrative advanced IS technologies, configured according to enterprise-wide business requirements, especially

when they need to monitor and collect information from various data sources for strategic planning.

The analysis of the reporting requirement dimension portrays a conflict between internally driven reporting requirements against externally accepted accounting standards. The internally driven reporting requirement is tailored to fit specific, unpredictable and fast-changing situations, directly affected by external environments. Spreadsheets are once more employed to assist these unstructured reports due to cost and time efficiency. However advanced IS technologies, particularly the ERP system and BI, are employed to support structured reports, namely GAAP complied budgets, presented for public audience.

The major implication from this analysis is that in general business controllers must apply budgeting IS technologies to fit the nature of budgeting tasks. When budgeting is used for unstructured decision-making, namely preparing budgeting to conform to operational purpose and management reporting, business controllers should employ IS technology which allows maximum discretion over data manipulation. This could certainly be seen as one reason for why business controllers use spreadsheets. The rational view of decision-making requires a complex data model (on an IS technology) to formulate all the essential dimensions of the environments as well as to determine and evaluate the best possible alternatives before a decision can be made. To employ advanced IS technologies like ERP or BI for the daunting task of decision-making could be seen as inappropriate because these systems are not primarily designed to support any unstructured data model needed for decision-making. On the contrary, it could be recommended for business controllers to employ advanced IS technologies, especially the ERP system and BI, for other management control processes, namely monitoring of actual performance in relation to budgets and preparation of GAAP compiled financial statements for budgets. These activities are characterised with certainties which can be directly translated into IS technologies as the author has discussed an IFRS-ready ERP system. These advanced IS technologies are deemed to be the most effective with regards to management control functions. In addition, it is recommended an integration of budgeting information between these advanced IS technologies, that is, a complete integration between ERP and BI, to ensure data monitoring efficiency and information accuracy.

Having analysed the needs for flexibility and integration in budgeting IS technologies using the concept of human agency in ST, the author concurs with Granlund and Malmi [18], Rom and Rhode [20], and Hyvönen [19] that the ERP system and BI applications have a moderate impact on budgeting practice. Indeed it has been shown that business controllers (the human agencies) only choose to employ these technologies when they are applicable to management control functions. Specifically, budgeting practice does not change according to these advanced IS technologies. Building on previous research, the internally-developed 'own BI' appears to have a similar moderate impact on budgeting, which is indifferent from the ERP system and off-the-shelf BI. The main conclusion thus far is that the needs for flexibility and integration in budgeting influence to a high extent which IS technologies are used. From the business controllers' perspective

they often choose to use spreadsheets since they see this software as fulfilling their needs for flexibility. Future research could well investigate whether budgeting should be led by any of these advanced IS technologies, ERP or BI? Although it is not possible to say that budgeting practices employed in the case organisations under study are flawless, the author does not think that budgeting, including any other business practices, should be driven by any kind of IS technologies. Businesses would be in a very dangerous position if the ERP system, for example, is used for local decision-making since the system is not designed to collect local data and/or present data in such a way that is useful for local decision-making. The same applies to BI application which receives a moderate preference over the ERP system in academic research [See for example: 20]. The author questions the validity of the comparison approach because these systems are designed for completely different purposes. Therefore they should not be compared for any reason. Indeed, the author proposes that it is more appropriate to employ a contingency approach to determine the circumstances which deliberately reinforce and weaken ERP and BI use in budgeting or other accounting control activities. Industrial research [38, 39] has advanced academic research with regards to this point. They have already criticised the BI system for having a weak interoperability and integration with the existing ERP system as well as complications in system design. These lead them to conclude why users do not prefer using BI for more complicated analytical works as it should be.

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Port Authorities and Water Concessionaires: The Role of *Reporting* in Management Control and Information Systems

Assunta Di Vaio and Gabriella D'Amore

Abstract Since 1994 the seaport services have been deeply reformed in order to improve service quality and to reduce public expenditure. These changes brought to the establishment of new public-private partnerships between Port Authorities (PAs) and private operators. In this context, the aim of the chapter is to investigate the reporting tools implemented by private operators (concessionaires) in order to support the PAs' decision system. Besides, we propose a new approach to the control of the relationship between the Port Authority (PA) and his concessionaire. In particular, through case study methodology, we analyze the management of water services in the Naples seaport system focusing on the way the information are exchanged between the PA and Idra Porto s.r.l. The findings show that, despite the positive performances achieved by the concessionaire, the systems implemented do not provide enough information on the activities outsourced by PA.

Keywords Port authority • Concessionaires • Water services • Outsourcing • External reporting • Management control • Information systems

1 Outsourcing Processes in the Italian Seaport Systems

Since the 1980s we observed a reorganization process in the public management sector which assumed different connotations depending on countries. These reforms changed the structures and processes of public sector organizations with the aim to achieve a better use of resources [1, 2].

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During these years, also the seaport system, among the others, has been drastically changed through several laws aimed at improving the port infrastructures' efficiency by *opening the doors* to private operators. This outsourcing process brought to a reorganization of functions and responsibilities.

Before these port management reforms, the sector was characterized by restrictive labour practices, incapacity to afford the increased demand, poor quality standards of port services and impossibility for many governments to invest in capital port infrastructures [3, 4]. Indeed, besides to improve port efficiency and service quality, the reforms were driven also by the need to decrease costs and prices and to increase competitiveness, improving the attitude towards port clients/users.

Consequently, the port reorder brought to the identification of different organizational models. In particular, Italian Ports are now characterized mainly by mixed public-private organizations, known as "landlord model", where the Port Authority (PA) provides the infrastructure, while the investments in superstructure and port operations are contracted out to private companies [3]. The ownership and the management of all the equipment and services, instead, are in the hands of private operators [see 5 for a review].

This kind of organization was introduced in Italy by the Law 84/1994, that created the PAs with the tasks of orientation, planning, coordination, promotion and control of port operations and industrial and commercial activities (art. 6, c. 1, letter c). However, the same article forbids PAs to manage directly port operations (art. 6, c. 6) and complementary services that have to be outsourced to private companies.

Also services like lighting, cleaning and waste collection, water, maintenance and repair, maritime stations and information technology are considered of "general interest" by the Law 84/1994 (art. 6, c. 1, letter c)), so their management has to be outsourced to mixed or private companies.

In this context, where outsourcing process are stimulated or required by law, there is an increasing necessity for PA to monitor and control the activities carried out by private operators and to avoid the risk to become prey of private operators' strategies. Considering the relationship between PA and concessionaires, it is possible to argue that the selection and the sharing of information on performances become critical factors.

In this chapter, we decided to focus on the analysis of water services in port areas, considering its importance for seaport users.

2 The Water Services Outsourcing

In Italy up to 90 years, water services were managed directly by local government or by concessionary organizations. The need to improve the quality of the service and to reduce public expenditure were the main reasons that brought the legislator to reform completely the water sector.

In particular the water sector has been deeply reformed since 1994 by Law n. 36, known as Galli Law by the name of its proponent.

The main points of that reforms were [6]:

- The integration of water services (water supply, wastewater and sewerage) in order to exploit economies of scope;
- The merging of water utilities in order to exploit economies of scale;
- The industrialization of water industries, in order to avoid the in-house solution;
- The definition of tariffs that cover both current costs and investments.

This brought to outsource of water services to new established private companies. For the Italian seaport system, the Law 84/94 and the Ministerial Decree n. 36/94 established the transfer of water infrastructures management from PAs to private operators, through a concession act. However, after almost three decades, only 13 ports (Ancona, Bari, Brindisi, Cagliari, Catania, Civitavecchia, Livorno, Marina di Carrara, Napoli, Palermo, Ravenna, Trieste, Venezia) outsourced the services to private companies, while other 11 are managed directly by the PAs.

Indeed, we have to notice that if on one side outsourcing in the last decades has been used as an instrument to reduce costs, on the other it does not always produce efficiency and social effectiveness increases. The frequent lack of cost reduction, the scarce quality of services provided, monitoring difficulties and the scarce attention to social accountability, in fact, determined the failure of several privatization initiatives [7].

To sum up it becomes critical for public managers the control, monitoring and reporting of services outsourced in order to see if the results achieved are coherent with public administration objectives and strategies and to safeguard the public interest.

3 The Information System and the Role of Reporting into Public-Private Relationships

Outsourcing processes increase the need of control the activities performed by external providers contracting entities. The information flows between the contracting and the contractor can concern both quantitative and qualitative data depending on the relationship between the two players.

Considering the huge relevance that all the port services have, it is easy to see why the PA needs of several and accurate information.

The governance of the relationship between PA and concessionary company grounds essentially on the concession contract. However, although there is a contract regulating the relationship between the “public” subject (PA) and the “private” subject (concessionaire), some conditions can threaten the good functioning of this relationship, among which we find information asymmetries. The accuracy in collection, elaboration and transfer of information is necessary to avoid mistakes [8].

In this study we intend to analyse a variable that according to us is critical for the good functioning of this kind of partnership: the reporting disclosure and the information systems used by concessionaire to relate with the PA. The knowledge of elements like information, language codes and softwares used becomes a critical factor for the relationship management [9].

According to Dekker [10] the control into Inter Organizational Relationship has the goal to motivate the partners to act in a “performance oriented” way and to coordinate the input-output information process within the relationship. Therefore, regarding the behaviours (control dimension) we analyze the control/coordination mechanisms. In particular, we focus on the reporting tools (ex-post control mechanisms) [11, 12] used by the concessionaire to communicate data on the services provided to users. A common tool used to collect and share information is the electronic data processing through some spreadsheets, such as excel. In the last years some PAs, like Venezia, have implemented Integrated Information Systems (IIS) that allow a rapid access to information needed and reduce the mistakes [13].

In the seaport system, the implementation of an IIS could permit to link not only the PA with the concessionaire, but all the members of the port community, such as truckers, customs, ship agents and so on, providing them higher quality and real time information. According to the World Bank [3], the use of an IIS is considered a source of competitive advantage and the ports unable to implement them will be left behind in the competitive ocean transport market.

However, the introduction of an IIS requires the sustainment of large investments, so the choice of implementing an IIS could be affected by different factors, like the resources available, the strategic vision, the effective needs, the competences of the personnel and so on.

4 The Case Study

The port of Naples is one of the most important seaports in the Mediterranean region handling a total of almost 20 million tons of cargo. In 2009 it was the first for the passengers traffic handled [14], more specifically for cruise passengers [see 15, 16 for a review]. In 2004, the PA started a company, called Idra Porto s.r.l. to manage water services in the port of Naples. The governance of this firm is shared among three entities: Naples PA who owns 20 % of capital shares (the total equity amounts at 500.000 euros), Sargenavi s.r.l. that owns 5.60 % and Marnavi s.p.a. owns 74.40 %, that is a trading company whose main business area is the transportation of drinkable water.

The concession act establishes duties and responsibilities of the company. In particular Idra Porto s.r.l. has to:

- Plan and manage all the activities related to port water services aimed at providing the drinkable water to the ships and customers in the port of Naples;
- Guarantee the water infrastructure maintenance;

- Manage all promotional activities and the related services, included market analysis.

In addition, it can execute many other activities that range from infrastructure building to financing other activities.

The strategic decisions are assumed by CEO that is composed by seven members. The president and another member are designated by PA, four are nominated by Marnavi s.p.a. and one by Sargenavi s.r.l..The election of president by PA reveals its need of controlling the right execution of activities related to water services provision in the port.

The supervision on all the activities is demanded on internal auditing committee composed by three effective members and two supplementary members; also in this case the president and one supplementary member are elected by PA, while the other two are elected by Marnavi s.p.a.

During the first years of its concession, through extraordinary and ordinary maintenance and rigid controls, Idra Porto reduced drastically the water losses and its related costs. Moreover, the water infrastructure is subjected to several rigid sanitary controls executed by the biologists of Idra Porto and by the technicians of the Local Health Care Unit.

These controls on 16 different points of the infrastructures are executed twice a week to guarantee the quality standards established by law.

However Idra Porto's main business consists into re-selling the water purchased from ARIN, the company that provides water services to the city of Naples, to port users. The tariffs, previously notified to the PA, are based on the water consumption and are subjected to adjustments due to costs or ISTAT increases. The water provided is measured by the meters that Idra Porto gives to all users. In order to provide water to stable port facilities, Idra Porto s.r.l. stipulates with them a contract, where are indicated all information customers need to know on how the service will be provided. The billing falls three monthly and is connected to the monitoring of all meters.

For boats the water meter is monitored at the beginning and at the end of the supply. The billing bases on the tariffs lists that include fixed rights, the cubic meters of water provided and the time slot.

5 The Relationship Between Idra Porto s.r.l. and Naples Port Authority: Control and Reporting Systems

One of the most frequent tool used to manage the relationship is the contract through which the public entity contracts out a service. The concession act of Idra Porto s.r.l. states that the PA can revoke the contract for any reason and without debate. The act establishes also that Idra Porto has to report periodically its activities to Port Authority to allow the monitoring of the financial and economic aspects of the service contracted out.

Each year the PA approves its annual financial statement, where is attached a judgment relation on Idra Porto's activities. From this relation it emerges that the PA:

- Monitors the respect of the law and constitutional act;
- Judges the economic financial and patrimonial operations implemented by Idra Porto on the basis of three monthly reports;
- Monitors on the adequacy to organizational, administration and accounting aspects;
- Evaluates and monitors the adequacy of the internal control and accounting system.

The analysis of the three last financial statements (2008–2010) shows a positive trend. However, Idra Porto's reporting activity to PA is almost completely based on financial ratios and the analysis of annual financial statements. In addition, it periodically reports to PA by hand, e-mail or fax data on the quantity of water supplied and the number of maintenance interventions done. This highlights the lack of any form of IIS.

These information are not enough to measure the performances of an external provider and to monitor and control how the services and activities are executed, especially if these are relevant for value production and public interest. So it could be useful for the PA to integrate the performance measurement system with a more complex tool, like the Balanced Scorecard [17]. Moreover an implementation of an IIS could help the PA in monitoring activities played by Idra Porto s.r.l. and also provide an useful exchange of information.

The Balanced Scorecard would give to PA a more complete view of the outsourced service to measure the results achieved by Idra Porto with performance indicators.

For this reason we tried to identify some indicators for each of the four perspectives considered by the model mentioned above.

The *financial and economic perspective*, as already said, is the only one considered by our case. It can be measured by indicators like ROI, ROE, ROS and so on, but these are not enough to have a clear view of the company performance.

The *customer satisfaction* is one of the most crucial points, especially for general interest services like water. Low performances could be the first signal of a future decline that could bring to the revocation of the concession. The customer satisfaction could be analysed through questionnaires submission on the service quality.

Another indicator that could be used is:

$$N. \text{ new services} / \text{Total services provided} \quad (1)$$

It measures the degree of attention to the development of new services that should integrate the already existing ones to improve the total quality and variety for clients.

The degree of quality perceived by customers could be measured with the following indicator:

$$\text{N. of complains/Total users} \quad (2)$$

Finally the number of events to which the company participated could be an indicator of the company's attention to promotional activities, in order to attract new clients and to consolidate the old ones.

Another perspective is related to *internal processes* that could be useful for managers to monitor the business functioning in every moment.

The control of quality could be measured through the Business Process Reengineering that is a way to organize the work in order to sustain better the company mission reducing the operating costs and improving the service. An indicator that measures the time needed to provide services could be useful to reveal improvements eventually implemented.

The fourth perspective is the *learning and growth*, that refers to the improvements of intangible assets like the intellectual, informative and organization capital. In particular, in this prospective, it is possible to identify the human resources capacity, IIS capacity and finally the empowerment. Thus, considering that the IIS is a critical point in the relationship between PA and concessionaire, we assume that the actually reporting system could be supported by the following indicators:

$$\text{N. information obtained in } t_1 / \text{N. information needed by PA on activities outsourced} \quad (3)$$

$$\text{Cost of IT training/IT cost} \quad (4)$$

$$\% \text{ of process with feedback about time, cost and quality} \quad (5)$$

This last indicators could support the decisions of both partners into improving the relationship systems. However, these considerations would only suggest the adoption of a model that supports better the monitoring and reporting of services outsourced by PA.

6 Some Final Considerations

This chapter contributes to the existing literature by investigating how PAs can improve the quality and quantity of information about the services they outsource in order to control the performances they achieve, that is essential at strategic level. More specifically, the chapter analyzes the external reporting, the management control and information system in the relationship between PA and concessionaire and, finally, we gave some insights on how the PA can improve its control activities by the use of a well known tool like the Balanced Scorecard.

Our case study evidenced that in the relationship between the PA and the water concessionaire, the public partner uses the participation to equity as the main control mechanism and the concession contract represents the main coordination mechanism. To monitor performance instead PAs relies on the financial statements and data on the water quantity supplied; information that companies reports through rudimental tools like fax or e-mail without any IIS. As for other “interest general services” (i.e. maritime stations), the PA prefers to be shareholder of the concessionaire in order to directly control the outsourced services. So, if on one side, many PAs followed Law prescriptions to outsource services for improving efficiency, on the other side they did not develop and implement the necessary management control tools and information systems.

Even though these considerations are limited to the analysis of our case study, previous studies evidenced the lack of any kind of integration in information systems in many other Italian ports [see 15, 16 for a review].

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The Impact of e-Invoicing on Businesses Eco-Systems: Evidences from Italian Supply Chains and Suggestions for a Research Agenda

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Abstract In 2007 the European Commission presented the Action Programme for Reducing Administrative Burdens in the European Union, with the aim to work with Member States in order to cut 25 % of administrative burdens on businesses by 2012. In this framework, a set of interesting actions can be summarised into the so-called dematerialization, intended as the substitution of the physical business documentation with digital files and archives that are able to provide better performances in terms of efficiency, as well as the same legal requisites of the documents in the paper format. The aim of this chapter is to introduce the approaches adopted from some Italian Supply Chains and provide some hints for further research developments.

Keywords Dematerialisation • e-Invoicing • Business management • Processes • Supply chain • Metrics • Operational costs • Simplification • Standards

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1 Introduction

The transition from paper to digital formats represents an extraordinary opportunity to radically rethink and redesign the administrative processes as it allows to make a significant improvement of the critical performance parameters in terms of cost, quality, services, timeliness and reputation. The ease of the availability of the entire invoice information in digital format offers relevant benefits over paper invoicing allowing a reduction of payment delays, errors and printing cost. More important, on the other hand, is the possibility to develop fully integrated processes where the invoice is sent in a structured format directly from the issuer's (or service provider's) financial supply chain systems to the recipient ones.

However, it is uncertain what is the current level of maturity of the document management technologies and which is the path for further implementations of such a change.

The introduction of digital document management systems within the businesses presents several technological, filing and organisational problems as well as issues related to the information management and to the integration with existing administrative structures and procedures.

We can briefly state that the critical factors in the transition from paper to digital formats are three: regulation, technology and organisation [1].

1.1 Regulation

With reference to the regulation, the legislators, both at European and National levels, are establishing a very structured regulatory system, continuously evolving, so the change of the legal framework represents one of the biggest risks in implementing dematerialisation projects for the verification activities involved, in order to identify the procedures for an effective and timely adaptation, especially regarding time and costs.

At the European level the Communication (2012) 712 [2] shows the commitment of the European Commission towards the electronic invoicing as the instrument for streamlining the supply chains, reduce the administrative burdens in line with the EU Action Programme and produce environmental benefits by reducing paper consumption and energy costs.

This high level commitment together with the current VAT commission directive (Directive 2006/112/EC) forced the EU members to implement their internal regulations accordingly and the article 21 of the Italian DPR 633/72 on VAT was amended in order to foresee the electronic (or, even better, digital) invoice as the perfect alternative to the paper one. The article 21 of DPR 633/72 then asks for some technical requirements that are needed for the ensuring the authenticity and integrity during the production and transmission of the digital invoice. The legal framework for dematerialisation in Italy is designed by the Code

of Digital Administration (Codice dell'Amministrazione Digitale–CAD) issued with Decreto Legislativo 7 marzo 2005, n. 82. The CAD provides the technical and normative standards for the:

- Digital signature as the main instrument able to ensure authenticity and integrity;
- Time stamp (Marca temporale) need for certifying in an undisputable manner the time of issue of a certain document;
- Certified Electronic Mail (Posta Elettronica Certificata–PEC) needed for the transmission of official documents between citizen, firms and governmental organisations;
- Digital protocol adopted by Public Administration through which is traced every step the document along the administrative process;
- Digital preservation and reproduction as well as the creation of the digital files and the dematerialisation of the paper ones.

Finally the Italian Budget Law 2008 (L. 244/2007 “Finanziaria 2008”) states that all the invoices towards Public Administrations must be issued, transmitted, stored exclusively in electronic format.

1.2 Technology

With reference to the technology, difficulties arise in managing the heterogeneous set of technologies involved (document management software, digital signature, PEC, physical storage, etc.), and there is the need to overcome the technological obsolescence of the different infrastructures to ensure the retention of administrative records for long periods, even indefinitely.

The final report of the Expert Group on e-Invoicing [3] proposed a European Electronic Invoicing Framework (EEIF) that is expected to establish a common conceptual structure, including business requirements and standard(s), and propose solutions supporting the provision of e-invoicing services in an open and interoperable manner across Europe. According to this purpose there is the need to:

- Create the bases for interoperability, facing issues with different business scenarios involving cross-sectors, cross-border, SMEs;
- Concentrate on machine processable formats;
- Create a framework where no single format/standard prevails or can be imposed.

These needs imply that:

- The core invoice must support basic business and legal requirements in a cross sectorial/cross border context and with SMEs;
- Specific sector/national requirements are addressed by specific formats/standards with rich and specific data models.

The final objective is then to have a single semantic core invoice data model which helps in achieving a basic interoperability (e.g., through automatic translations) and EC COM (2010) 712 suggests to verify through field tests the suitability of the Message User Guide (MUG) core invoice data model (CWA 16356) [4] as well as the syntax implementation guideline of the UN/CEFACT Cross-Industry Invoice D09B XML schema.

In Italy there are several organisations and projects that are testing and developing similar standards. These are:

- FatturaPA (e-Invoicing to Italian Public Administrations);
- CBI (banking system);
- eProcurement (PEPPOL);
- Specific business sectors:
 - DAFNE (pharmaceutical distribution);
 - EDIEL (large-scale goods distribution);
 - INDICOD-ECR (Italian WebEDI based on GS1 standard);
 - METEL (electrical equipment).

The MUG data model has been compared against FatturaPA, CBI and PEPPOL with the result that almost 90% of the fields (100% of mandatory elements) can be directly or easily mapped. The next steps will consist in the analysis against specific application scenarios such as utilities, SMEs, etc.

With the aim of streamlining the processes of transformation and modernization of the Italian bureaucracy was set up a “Working Group for the dematerialization of documents via digital media” and the Ministry of Finance promoted the “e-Invoicing Forum” with the aim to develop and share the standards for dematerialisation and having as a first milestone the development of the scenario of e-Invoicing towards public administration.

These bodies have the following duties:

1. to identify criteria and technical procedures in digital format for storage of different types of administrative documents, which will gradually replace the ones on paper;
2. to advise the technical rules for the transmission and display of documents in digital form, in order to ensure integrity, compliance and origin;
3. to propose actions aimed to streamline, amend or supplement the law in order to facilitate the management of digital documentation.

1.3 Organisation

From the organisational point of view, new roles, responsibilities and new methods for transaction management and archiving are assigned. In particular, the main problems are related to the governments’ “hybrid” archives and this just one scenario of the coexistence and the overlap of the new procedures with the old

storage mechanisms. Indeed, the document, is created and made available in digital form, but is reproduced on paper to manage it. The digital document, unlike the paper, it is not self-consistent and this implies the need to keep in time and space not only the document itself, but also all the elements necessary to demonstrate its authenticity, its probative value and historic preservation such as protocol ID, archive classification and digital signature.

Certainly, an obstacle to the dematerialisation process is related to the general scepticism about information technology derived from Italian cultural tradition, for which the paper, is commonly regarded as “safer”. The distrust is due also to the fact that, unlike the digital document, to use a paper document we do not need intermediaries. Today and in several years, if properly stored, the document will remain accessible, reproducible and portable. Indeed, in the transition from paper to digital form, lies the problem of the future reference of previously filed documents. A sequence of bits does not provide any information if there is not a program enabling the encoding, so we need to manage the risk of technological obsolescence of media formats and reading tools.

However despite of these scepticisms and of the technical, organisational and regulatory issues that are rising it is expected that at the end of 2012 the electronic invoices will be the 5% of the invoices issue all over the world [5, 6]. In Europe approximately 2 billion of e-invoices will be issued towards consumers and 2.88 towards businesses and governments with an annual increase of respectively 25% and 30%. The potential savings (only of the e-invoicing) that can be reached in the European public sector is estimated in 40 billion Euros while today less than the 10% of this huge potential is exploited so far.

According to Perego [7] the savings that can be obtained go from 1 to 2 Euros per invoice for the models of substitutive conservation, up to about 23 Euros for the case of the entirely digitalised process. Koch [8] estimates that the saving for the invoice issuer can be 7–10 Euros while the saving for the recipient can be 10–25 Euros; if we apply these figures only to Italy where 3 billion of invoices are exchanged every year then we realise how big is the potential impact especially if we interpret it as the integration of the Financial Value Chain and the Supply Chain [9].

In this direction several private initiatives have grown in the last decade.

2 Initiatives

During the recent years also private companies developed interesting initiatives moving from the fact that each supply chain presents its own peculiarities. In the following paragraphs we have considered three of these supply chains that currently are the most advanced from the technical and organisational points of view.

2.1 DAFNE

Distribuzione Aziende Farmaceutiche Network EDI (DAFNE) is a supply chain consortium participated by pharmaceutical companies and intermediate distributors with the aim of optimising the logistic processes among the pharmaceutical supply chain and the related administrative management. The integration among partners is performed through Internet and EDI standard (EDI/EDIFACT, Flat (TXT), XML, CBI).

Currently DAFNE is developing the dematerialisation of the entire order cycle through three twin projects. The projects are:

Logistic Cycle (Progetto Logistica Collaborativa). The Logistics documents digital transmission (pre-delivery note and delivery note with unit, batch nr. and expiry date) before the goods' delivery, allows a better management of the purchases and the warehouse stock. Through the document certifying the goods' delivery, the information on delivery time and quality of the service is provided.

In 2011 (in comparison with 2010) the supply chain has shown the following figures: Orders 882,000 (+10%), Hospital Orders 118,000 (+55%), Confirmations 262,000 (+2%), DDT (Documento Di Trasporto—Shipping note) 180,000 (+165%), Receipt Acknowledgement 83,000 (+279%).

This approach presents the following advantages:

- goods delivery planning;
- better management and balance of the stocks area;
- integrated management of batches and deadlines;
- recall management on the supply chain;
- reduction of expired drugs.

Figure 1 shows how the current DAFNE workflow enable the delivery of goods in four days from the order providing the infrastructure for the integration of the Financial Value Chain with the Supply Chain.

Accounting Cycle (Progetto Fattura Elettronica). The digitalization of the entire invoicing process goes from the electronic invoice to the electronic filing of documents for the supplier and the client. Financial services with added value are also provided such as the advanced invoice transmission, the immediate documents check, the collection and the payment. In 2011 452,000 invoices (+148 % on 2010) have been issued of which 409,000 were also stored with on Intesa Sanpaolo bank facilities in the legally compliant alternative manner.

Hospitals Project. The project involves 108 Local Health Administrations (ASL) managing 808 assistance points that exchange dematerialized documents (using DAFNE standard) with pharmaceutical companies and intermediate distributors.

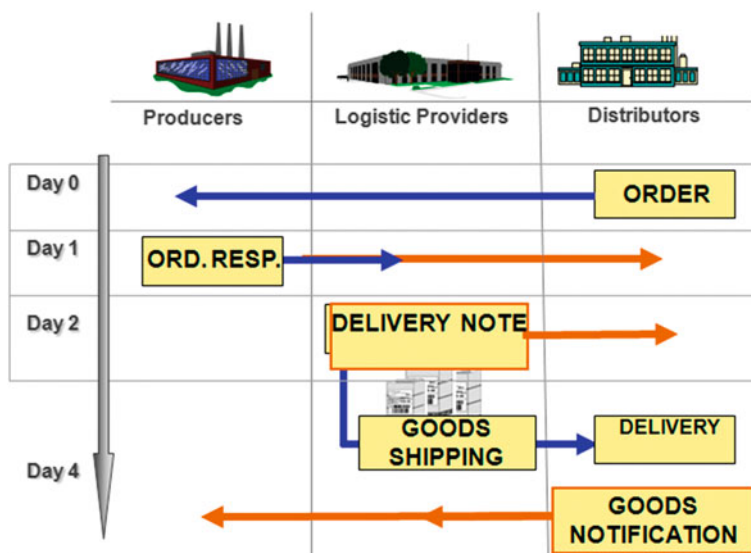


Fig. 1 Order workflow (Source DAFNE)

2.2 EDIEL

EDIEL is the organisation that involves the companies operating in the consumer electronics supply chain with the aim of improving the collaborative capacity among player through the adoption of a common communication protocol for the digital transmission of business information. EDIEL is currently implementing 5 projects aimed to the complete integration of supply chain management:

- EDI order cycle;
- Collaborative logistic;
- Legally compliant digital storage;
- Commodities classification;
- Vendor Management Inventory (VMI) and Continuous replenishment process (CRP).

Forthcoming projects (2012–2015):

- Electronic catalogue;
- 24 months Guarantee management.

2.3 METEL

METEL coordinates the development of the supply chain communication standard for the sector of electric and illumination material that has a 7 billion turnover in Italy.

During the years METEL has developed and integrated management of the order cycle through the following components:

- Electronic catalogue;
- Order;
- Order confirmation;
- DDT;
- Invoice.

METEL has also developed an ad hoc procedure able to guarantee the formal and syntactic validity of the documents circulated in the METEL circuit.

Table 1 shows the main figures of the METEL consortium [10] which already integrates the Financial Value Chain with the Supply Chain.

Table 1 METEL main figures (*Source* METEL)

	Distributor	Producer
Electronic catalogue	420 certified producer adopting METEL Catalogue. This is the reference Standard for the sector	5 billion € market for the producers that update the information systems of dealers and distributors
Order	160 dealers sending 1,000,000 orders/year	100 producers and 14,000,000 order lines/year
Order confirmation	120 dealers and 1,300,000 documents managed (delivery date and quantity)	60 producers use the order confirmation in order to measure the service level
DDT	160 dealer that receive the DDT from producers	100 producers that send 2,000,000 standard DDT/year
Invoice	5 Purchase Groups and 160 Dealers that receive the invoice issued in a centralised system	100 Producers send 1,100,000 METEL standard invoices to the customers

3 Measuring Business Performance

Recent studies [11] shown significant savings that are obtained through the dematerialisation process along the above described value chains.

Figure 2 shows the cost reduction (in Euro) obtained through growing degree of dematerialisation for the different phases of the process.

The data in Fig. 3 show also a dramatic decrease of the costs generated by not compliant documents along the value chain.

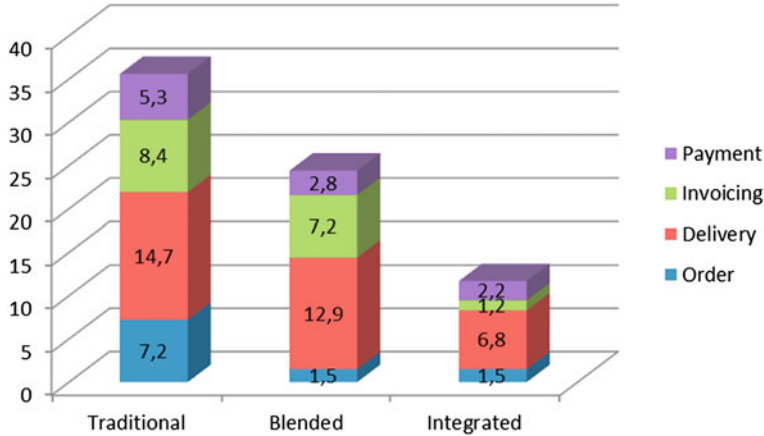


Fig. 2 Traditional order cycle versus *blended* or *integrated*, savings in € per invoice (Source METEL/POLIMI [14], adaptation from authors)

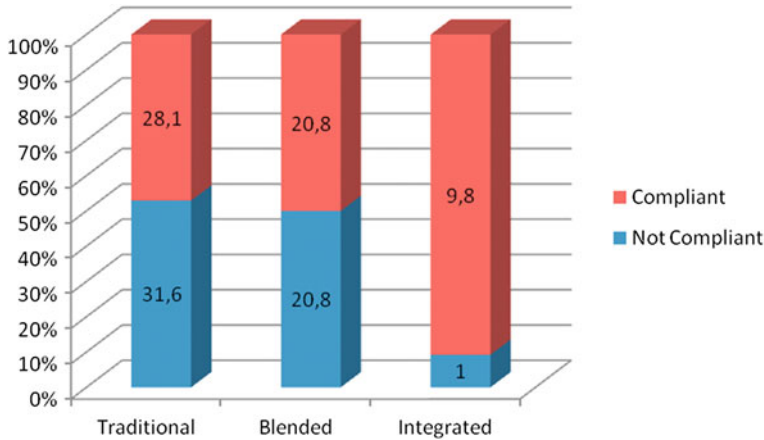


Fig. 3 Traditional order cycle versus *blended* or *integrated*, compliance costs in € per invoice (Source METEL/POLIMI, adaptation from authors)

The research question is now to understand which are the best indicators that integrate the existing ones allowing to capture and synthesize the interactions between the Financial Value Chain and the Supply Chain [11]. According to Kaplan and Norton [12], also in this case, it is important to find a suitable metric able to provide a clean picture of the organisation performance beyond the traditional dichotomy between financial and operational performances. Indeed also the European Commission recently stated within the Single Market Act II the need to “make electronic invoicing standard in public procurement procedures a proven money-saver”.

Table 2 Financial and supply chain dematerialisation performance metrics

Typology	Indicators
Strategic performance metrics	Variances against budget
	Order lead time
	Information processing cost
	Total cycle time
	Total cash flow time
Order planning metrics	Level of energy utilisation
	Customer query time
	Accuracy of forecasting
	Planning process cycle time
	Order entry methods
Supplier metrics	Human resource productivity
	Supplier delivery performance
	Supplier pricing against market
	Efficiency of purchase order cycle time
	Efficiency of cash-flow method
Delivery performance metrics	Supplier booking in procedures
	On time delivery of goods
	Effectiveness of enterprise distribution planning schedule
	Effectiveness of delivery invoice methods
	Number of faultless delivery notes invoiced
Financial metrics	Payment delay
	Invoice production costs
	Invoice delivery costs
	Invoice filing and storage costs
	Investments for the adaptation of the information systems

We hereby propose a set of indicators drawn and adapted from the supply chain evaluation metrics elaborated by Gunasekaran et al. [13].

Table 2 synthesizes the set of indicators for measuring the performances of an integrated and dematerialised Financial and Supply chain. This proposal will need to be validated through a survey among companies’ CEOs.

4 Conclusions

According to these interesting evidences becomes of fundamental importance the implementation of following actions:

1. The simplification of the legislation and the harmonisation at European Level to remove certain documents required by the government that are no longer necessary after the introduction of the principle of circularity of the availability of data and databases (OpenData).

2. The study of organizational problems related to digital document management and its integration within the structures and administrative practices, with particular reference to the definition of responsibilities in the processes of document management with respect to administrative procedures.
3. The dissemination of good practices dedicated to these issues, developed following the analysis of several critical issues encountered during the implementation in different sectors and value chains.
4. The implementation of monitoring and quality assessment tools by identifying a standardised set of KPIs related to efficiency improvements generated by dematerialisation in order to allow businesses and administration to easily calculate the performance improvements.
5. The identification of storage standards that ensure the preservation of documents in compliance with the legal requirements (i.e. tax compliance) beyond the obsolescence of adopted technologies.
6. The assessment, also at the aggregated level, of the impacts generated by dematerialisation initiatives on the PAs management after the shift from traditional towards blended and integrated approaches.

Finally, we believe that the development of the dematerialisation culture represents the occasion to change the perception of the management information systems from an ancillary role to an integrated one in the firm's management of production and delivery.

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The Didactic Challenge of Accounting Information Systems and ERPs for Business Schools: A Proposal for the Italian Universities

Renata Paola Dameri, Roberto Garelli and Francesca Ricciardi

Abstract The strong integration triggered by the adoption of Enterprise Resource Planning Systems (ERPs) impacts many processes and tasks; the way accounting data are collected, elaborated, communicated and used often changes even dramatically when an ERP system is adopted. This design-oriented paper stems from multi-year didactic experiences in the Italian context, where the Business Economics courses still poorly take into account the emerging educational needs stemming from this scenario: in most Italian universities, in fact, subjects such as accounting, administration, controlling and auditing are taught according to traditional approaches, which tend to see these activities as scarcely integrated with both the operations and the strategic management processes. This paper proposes a framework for innovating the educational strategies for basic and advanced courses related to accounting, administration, controlling and auditing, in order to fill the identified gap between real-world demand and higher education supply in this context.

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1 Introduction

Enterprise Resource Planning (ERP) systems are growingly present not only in large organizations, where they have reached impressive penetration rates, but also in Small and Medium Enterprises (SMEs) [1].

ERPs are modular, highly integrated Information Systems, aimed at rationalizing and automating processes by building a unified database throughout the whole organization. The (successful) adoption of an ERP can be so important, that it is often considered a reliable measure of the organization advancement [2].

The adoption of ERP solutions, in fact, requires an in-depth transformation of the organization, not only from a technical point of view, but also from an organizational and cultural standpoint [1].

Processes and tasks are deeply impacted by ERPs throughout the whole organization, and jobs focusing on the accounting, administration and controlling processes are among the most involved in the revolution stemming from the adoption of such systems [3].

Oddly enough, whilst the importance of ERP systems for accounting, administration and control jobs is almost unanimously understood, the educational programs of most Italian business universities tend to neglect this subject.

But the adoption of ERPs has changed and is further changing the activity of making business, not only as for the operations, but also as for business decision making processes. Concepts underpinning the traditional activities of business economics are evolving, and the educational programs should strive to meet the emerging needs more effectively than now.

In the next paragraph, we will describe the impact of ERPs in jobs involving accounting, administration, auditing and control processes. We will seek to demonstrate that this impact is very important and requires properly educated workers, in order to effectively take on the innovation challenges put out by ERP systems.

In the following paragraph, we will describe today's educational programs in Italian business economics universities. By using a concept matrix developed ad-hoc, we will identify the main gaps between the courses and programs proposed by the universities, and the actual needs expressed by the world of practice, as for accounting, administration and control activities.

Then, our proposal will follow. We sought to design a novel educational approach for subjects related to business economics, on the basis of the framework identified for analyzing the state-of-the-art. The model was developed on the basis of a design-oriented approach [4]. We synthetically describe this model in the last paragraph.

In the Conclusions, we will briefly synthesize our outcomes and we will suggest possible directions for further research.

2 The Impact of ERP Systems on Accounting-Related Activities

The core feature of ERP systems is integration. The strong integration required and caused by ERP adoption is the key factor for understanding the “culturally revolutionary” impact of ERPs on accounting-related activities.

Following [1] and [5], we will describe the integration triggered by ERPs as working at three different levels:

Information Integration. All the data generated by, or collected during, the activities managed by the different ERP modules are registered in a unified database. Since all the data are consistently collected and organized, they can be compared, combined and co-processed in all the ways, independently from the source, according to operational and administration needs;

Operational Integration. The operations constituting the different primary business processes are designed and seen as linked together, because ERPs imply that the “if and how” an operation is performed influences in a pre-determined way the “if and how” the following operation is, in turn, performed throughout each business process;

Time Integration. Data entry is performed only once, so that the possibility of error and of data inconsistency is minimized. Moreover, data entry does not occur as a final step of the process, i.e. once the operation is ended, but at the very root of the operational flow. In this way, it is always possible to know what is happening throughout the chains of processes, so that checking activities and exception management are easier and more effective. The feed-back cycle is immediate, since the operations are continuously guarded. Most time delays, typical of traditional processes, are compressed, and operations immediately generate data, which in turn immediately or very quickly generate other operations, feed-backs and decisions.

How does the adoption of ERPs, with the integration processes connected with it, change the accounting-related activities?

We propose here that accounting activities can be divided into three phases [6]: (i) standards and rules setting; (ii) data collection; and (iii) data interpretation.

The first phase (standards and rules settings) involves the definition of the norms ruling the double-entry bookkeeping and the other accounting activities.

The second phase (data collection) involves data gathering and recording.

The third phase (data interpretation) involves the utilization of data for further processes, and in particular for the decision-making processes.

The core phase in traditional accounting activities was the second one, i.e. data collection. Accounting people were essentially data collectors and designers/controllers of computational activities.

But the three-fold integration (information, operational and time integration), generated by ERP adoption, and described above, changes the focus of accounting activities. In fact, ERPs imply that great efforts are made in the first phase, i.e. the standards and rules setting phase: when standards and rules are effectively set, the

second phase, i.e. data collection, occurs automatically, during the very execution of operational activities [7]. As a matter of fact, when an ERP is running, the data entry of accounting data is almost never directly executed by the accounting people, but it occurs in real time, in the several and different departments, as several and different business processes go along. In the ideal ERP, the data are (almost) never written directly on the ledger: the administrative “books” are fed by the systems managing the different primary business processes. In other words, ERP adoption dramatically increases the importance of the rules and standards setting phase, whilst the data collection phase becomes little more than a mere automated consequence of the first phase. For this reason, standards and rules setting is perhaps the most critical phase in ERP adoption [6], and it requires that those who set standards and rules are capable of both sound administrative/accounting competences and good process-oriented vision of the operations.

In a similar way, the adoption of ERPs increases also the importance of the third phase of accounting activities, i.e. the data interpretation phase. ERP systems collect and process enormous amounts of data and can provide managers with valuable tools for decision-making.

But, again, an effective exploitation of these potentialities requires important advancements in the organization’s accounting culture.

A smart, aware and wise use of the system is essential in order to prevent that important knowledge remains hidden in the ocean of trivial data, on the one side, but also that decision-makers are overwhelmed by information overflow, on the other side.

People using the ERP system for reporting must then have competencies not only on data interpretation, but also on data generation: in-depth understanding is needed, in other words, on how and where and why data are generated, and on how they travel throughout the system.

Under these conditions, it is possible to design effective data extraction for decision-making, both for recurrent operations and for business decisions. In order to support decisions and control for recurrent operations, a push strategy is usually implemented, so that the involved people automatically receive the needed information. On the other side, in order to support exception control and decisions related to business goals, a pull strategy is usually preferred, so that people are given the possibility to ask for the specific information they need in the specific situation [8]. In both cases, data can be selected and aggregated in innumerable ways, so that, for example, a very specific view on a specific problem is attained, but also so that a wide scope analysis is provided. In other words, well-designed ERPs can generate valuable interpretations about how and why a certain business performance was achieved: thus, data value can be magnified by these systems, but under the condition that ERP users, accounting people included, are properly educated to get the most out of this kind of systems. In this field, a sort of competition between ERPs and Business Intelligence systems is coming out [9].

Another important consequence of ERP adoption concerns the organizational structure. ERPs, in fact, tend to flatten the organizational structure, because of their modular and strongly processes-oriented architecture [1]. An ERP sees the

organization as a two-level system: at the basic level, the operational processes take place, made of activities and individual operations; at the governance level, the activities of business control, performance measurement, and performance communication take place. ERPs make the so-called short feed-back possible: the execution—measurement—control—correction cycle is concentrated in a single integrated process. This forces to overcome the traditional separation between operations, accounting data collection, data processing, performance control, and decision making: all these activities are concentrated in a sort of unified, wide-range activity, crossing all functional boundaries. Moreover, thanks to the activity integration provided by the system, data are more easily passed on from the operational to the executive levels, where the information arrives already conveniently synthesized and available for further, customized processing. As a consequence, the need for in-between organizational levels decreases.

In a nutshell, we sought to show that ERP adoption changes the organizations, so that novel attitudes and competencies are requested to human resources. It is not (just) about being capable of using a specific ERP software: organizations can easily train their employees to do so. We are talking about the ability to understand how operations and information flows are strictly linked, and how well-designed information flows can contribute to support a virtuous circle where accounting and operational processes improve each other.

In fact, efficiency is enhanced by the unification of the operating subjects and by the real-time nature of data collection. Effectiveness is enhanced by the immediate feedbacks: errors and problems can be fixed sooner, since they are immediately identified.

3 The Influence of ERPs on Educational Programs of Business Schools: Literature Review and Analysis of the Italian Case

In the paragraph above, we sought to demonstrate that the wide-spread diffusion of ERPs results in novel approaches and capabilities requested to accounting-related jobs. Such skills do not just come down to “software expertise”: even more importantly, they imply a novel way of understanding the administrative activity.

The traditional approach presumed that ERPs are a subject for engineers and computer scientists; but this idea should be overcome. ERPs challenge the traditional definitions of expertise and roles of accountants, and lead to forms of hybridization between the accounting people and other professional groups [10].

In other words, it is becoming clearer and clearer that ERP and Accounting Information Systems skills must be part of the education not only of engineers and computer scientists, but also of business graduates.

These competences and capabilities are not easy to find on the job market. The shortage of AIS/ERP-related culture and skills in business schools graduates has

been analyzed and demonstrated by several studies (see for example [11]). But there is a growing awareness that accounting-related jobs are necessarily tied to IT culture. This problem raised an academic debate on the educational challenges posed by the diffusion of the integrated AIS systems, such as the ERPs.

Literature focusing on this issue seems to concentrate on some recurrent purposes. The first purpose is providing a justification for the inclusion of ERP contents in university curricula. This innovation is justified and hoped for on the basis of the impact of ERPs in the world of practice: for example, [12–14].

Other publications choose a case-study approach and report about how the ERP educational challenges have been addressed in a specific course or curriculum; for example, [15–17].

Some writings report about experiences of alliance programmes between universities and ERP vendors for promoting practice-oriented courses: for example, [12].

Other papers describe surveys and experiments aimed at demonstrating that hands-on ERP courses improve students' performances and employability: for example, [18].

A few papers display a more strategic view on the educational issues raised by the inclusion of ERP courses in business curricula [19–21]. More specific papers are dedicated to the emerging REA model for teaching ERP-related issues [22, 23].

In any case, the importance of education-related issues as for ERPs is widely perceived: in 2004, the Journal of Information Systems Education (JISE) published a special issue completely dedicated to this topic [24]. But most literature focuses on the Anglo-Saxon educational context. Few international publications are available on other national contexts, such as, for example, Korea or Germany [25].

We found that the Italian case has not been described by scholarly literature so far. Italy is part of the G7; it is the second industrial country in Europe, and one of the most important industrial countries in the world: after the global crisis following the 2008 well-known financial crashes, the need for innovation is even more critical in this country, and the universities are expected to give an important educational contribution to boost the culture and skills of the new cohorts of human resources.

We then felt that a study on the possible role of AIS/ERP-related educational strategies in innovating the curricula of Italian business universities could be a relevant contribution.

Thus, we decided to conduct a research for assessing the state-of-the-art in a representative sample of Italian business universities.

We selected the following 10 universities: *University of Turin, Piemonte Orientale University, Catholic University of Milan, Bocconi University of Milan, University of Trento, University of Genova, University of Pisa, University of Rome—Tor Vergata, Parthenope University of Naples, University of Catania*. These universities were chosen in order to represent the different Italian geographical areas; the sample includes both private and state universities and the most popular Italian business faculties are well represented. We then deemed that the sample was appropriate to our goals. All the selected Universities provide

detailed descriptions of their curricula in their web sites. We then thoroughly analyzed the year 2010–2011 curricula and syllabi of the Bachelor's Degree of Economics and Business of each university.

We found that the curricula for business, administration and accounting courses are substantially similar and they are structured into three didactic areas:

1. First didactic area: classes where the *basic and preparatory subjects of Business Economics* are presented. Students are introduced to the basic concepts about how businesses work, about business processes, and about the more relevant quantitative business indicators;
2. Second didactic area: classes where the *accounting subjects* are more specifically addressed. Students learn about subjects such as accountancy, book-keeping, double-entry journal, and they deepen their knowledge on the related laws and norms;
3. Third didactic area: classes where *budgeting, cost analysis and business control* issues are addressed. Students learn about different approaches for measuring, evaluating and controlling business performances.

The syllabi of the courses mentioned above almost never mention ERPs as a subject of study. On the other hand, most of the analyzed universities propose classes (which are usually optional) dedicated to a specific ERP software. These courses may be poorly effective in providing real hands-on experience, since the Italian business universities are often over-crowded and the classrooms provided with computers are often insufficient. As a result, it is difficult that AIS/ERP related skills are developed in an integrated fashion—if they are developed at all. On the one side, traditional courses, both the basic and the advanced ones, still mirror an old-fashioned situation, where the accounting activities were not culturally influenced by ICTs; on the other side, hands-on training on ERP software is not systematic and it is presented as a separated, optional subject, belonging to the computer science field.

In a similar way, the accounting subjects are taught as a separated field that has little to do with the field of operations and business processes, on the one side, and with the field of evaluation and strategic decision making, on the other side.

4 For a More Process-Oriented View of Organizations: A Framework for AIS/ERP-Oriented Innovation of Italian Business University Courses

After the analysis of the state-of-the-art in Italian universities, described above, we decided to design and propose an alternative approach to the courses of the three didactic areas identified above (*Basic and preparatory subjects of Business Economics*; *Accounting subjects*; and *Budgeting, cost analysis and business control*).

In other words, we propose here an updating of the traditional theoretical business economics courses, both the basic and the advanced ones, so that a sounder process-oriented view is encouraged among students. We suggest that this achievement would be very important, especially in those situations where it is not possible to provide all students with comprehensive and effective hands-on courses focused on ERP software. This goal should be achieved by extending and enriching the syllabi and the didactic approach of such traditional courses. Our proposal stems from discussions and beliefs rooted in our multi-year teaching experience and in continuous confrontations with students, colleagues and firms.

More specifically, we propose that business schools take into greater account, when designing courses, the importance of the relationship between business processes, on the one side, and information flows, on the other side.

Students must be given the possibility to really understand how and why the flows of activities and resources activated by business processes generate (and are generated by) the flows of information within and between firms. Only if this cultural goal is achieved, will the students be able to understand the potentially pivotal role of accounting activities in today's business settings, and to get the most out of ERPs—both in the case they are given the possibility to learn how to use an ERP software during the Bachelor's courses, and in the case they are trained to it afterwards.

We then propose the following didactic framework, identifying three key aspects of information flows. This framework is consistent with Porter's classical value chain model, and links the different types of processes to different phases of information flowing. According to this model, we can identify:

1. The *data generation* phase, which mainly occurs when *primary processes* are performed. Primary processes, such as sourcing, logistics, production, distribution and sales, are all those processes that create customer value. In an ERP environment, primary processes imply flows of activities and resources, and generate the basic data that feed the information system. Such information flows, in turn, trigger further processes. Accounting activities were traditionally involved in this phase for data collection (see above), but in ERP-oriented environments, accounting people are usually involved in this phase for *standards and rules setting* (see above), in order to effectively link the data sources to the streams where information is expected to flow;
2. The *data processing/systematization* phase, which occurs during the *administration and support processes* mainly. In this phase, data are expected to be transformed into valuable information, available where and when needed. In an ERP environment, Administration and Support processes must contribute to guarantee that the information flowing throughout the system is efficient, effective, consistent and compliant. Accounting activities were traditionally involved in this phase for *data collection and computation* (see above); but in ERP environments, the most important contribution of the accounting people to this phase consists, again, in *standards and rules setting*;

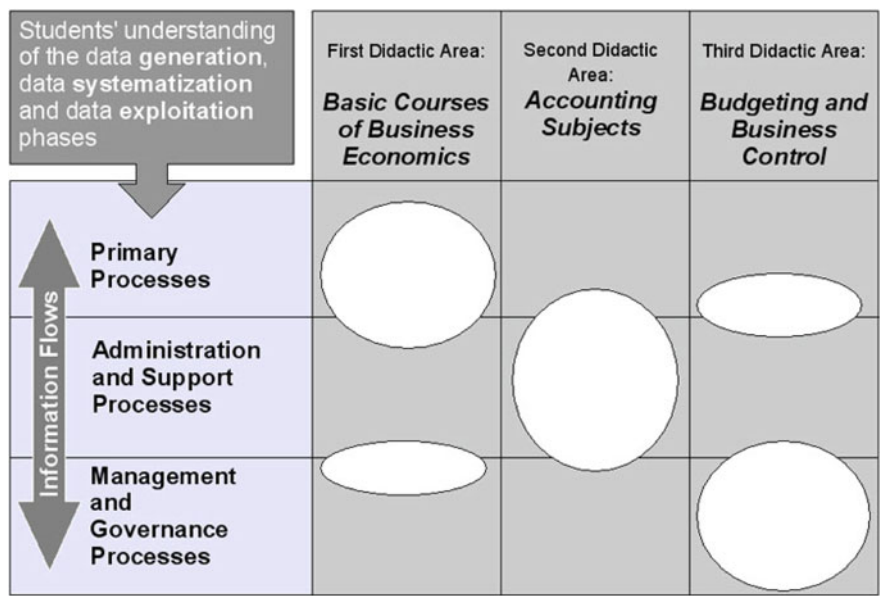


Fig. 1 Didactic contents in undergraduate courses: the Italian situation

3. The *data exploitation* phase, which occurs during the *management and governance processes* mainly. In this phase, the executive levels make use of the information resulting from the previous phases in order to evaluate performances, foresee possible future situations, analyze what-if scenarios, and make decisions. Accounting activities are usually involved in this phase for *data interpretation* (see above).

After defining this three-phase model of information flows, we can combine it with the three-area model, synthesized above, describing the recurrent features of business curricula in Italian university. What comes out is a double-entry matrix, which can be used both for describing today’s state-of-the-art (see Fig. 1) and our innovation proposal (see Fig. 2).

4.1 First Didactic Area: Business Economics-Basic and Preparatory Subjects

In this educational area, theoretical frameworks are provided for understanding the economic aspects of organizational life, and for understanding how the organizational structure faces its competitive environment. The different possible types of businesses are described, along with basic concepts such as, for example, governance, strategy, or value. In today’s situation, these courses may include an

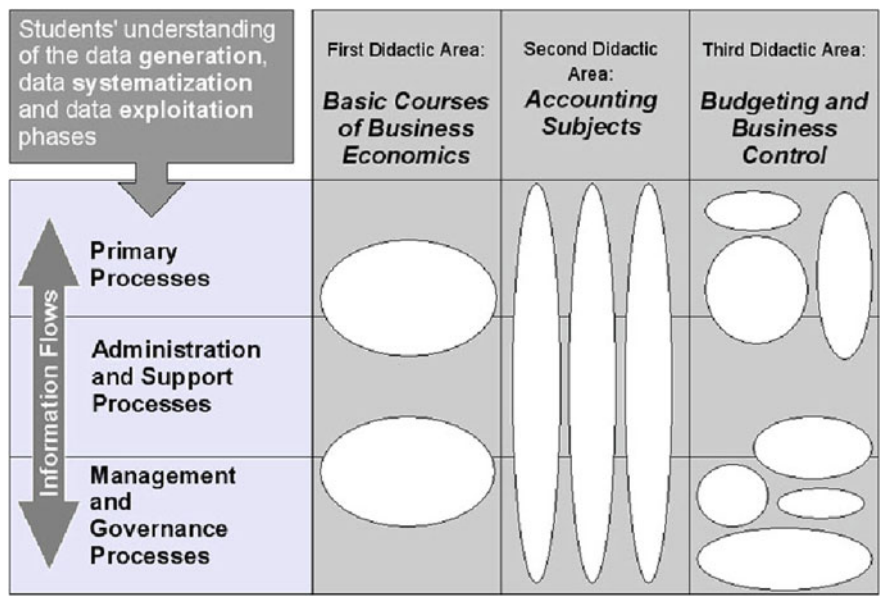


Fig. 2 Didactic contents in undergraduate courses: an AIS/ERP-oriented innovation proposal

introduction to information flows, but they tend to concentrate on the primary processes (phase A, see above) and on the management and governance processes (phase C, see above). On the other side, the information flows regarding the administration and support processes (phase B, see above) are often scarcely described in these courses (Fig. 1). As a result, it is difficult for students to figure out the integrated nature of the process chains. In our proposal (Fig. 2), we suggest that also the basic courses insist on the fact that the administrative and support processes are the ring linking the operations (primary processes), on the one side, and the decision-making (management and governance processes), on the other side.

4.2 Second Didactic Area: Accounting Subjects

In this area, the educational goals are essentially related to the understanding of methods and techniques to collect business data through bookkeeping. Official and institutional reporting activities are at the core of these courses' syllabi. Moreover, methods and techniques for business evaluation are sometimes provided. In today's situation, these courses tend to overlook the importance of the primary processes (phase A, see above) and of management and governance processes (phase C, see above) for successful accounting activities. In fact, students are rarely invited to reflect on how primary processes can generate documents and data that are essential for effective accounting activities, or on how the quality of

information flows stemming from the administration processes can influence the managerial and government level (Fig. 1). In our proposal (Fig. 2), we suggest that efforts are made for underlining the relationships linking the administrative processes with the primary processes, on the one side, and with the management and governance processes, on the other side.

In particular, students should receive more information on the importance of different types of non-institutional reporting, such as, for example, Business Intelligence.

4.3 Third Didactic Area: Budgeting, Cost Analysis and Business Control

This area includes many specific courses where many different approaches to performance analysis are described. Students receive detailed information on issues such as, for example, reporting standards, legal issues, or evaluation methods. In today's situation, these courses include some references to the importance of the data generation phase, which occurs within the primary processes (phase A, see above), but the syllabi concentrate on the management and governance processes mainly (phase C, see above), whilst the critical role of support processes (phase B, see above) is sometimes poorly highlighted. In our proposal (Fig. 2), we suggest that these courses should provide more information on the critical aspects of reporting: rigidity and information overflow are recurrent problems when the data arrive on the executives' desks, and a boost to reporting culture is probably essential to provide a better understanding of how reporting can be usefully made more flexible and more customized in AIS/ERP environments.

5 Conclusions

ERP systems are more and more spreading also across small and medium enterprises and their adoption implies important innovations in organizations. New approaches and new skills are being requested by companies, and the universities are called into action. Management literature is addressing this issue and there is a stream of academic writings focusing on the question: *how should we innovate higher education strategies and programs in order to meet such emerging needs?* This paper analyzes the Italian situation, which has been overlooked by literature so far. We studied the business economics curricula and syllabi of ten popular Italian universities. We built a framework for analyzing the retrieved contents, and we found that there actually are didactic areas whose contents should be re-organized and enriched. On the basis of a design-oriented approach, the final outcome of this paper is a blueprint synthetically describing the didactic

innovations we propose. We sought to demonstrate that “teaching how to use an ERP software” is not enough: it is even more important that also the traditional courses of business economics, accounting and business control are updated, in order to effectively enhance the students’ understanding of the integrated nature of business processes and of information flows in today’s organizations.

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