BUSINESS ADMINISTRATION AND ACCOUNTING STUDIES

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BIG DATA AND ANALYTICS IN ACCOUNTING

Theories, regulations and implications

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Introduction

Digital technologies such as big data analytics (BDA) are being increasingly used by businesses to create economic and societal value (Ferraris *et al.*, 2019; Constantiou and Kallinikos, 2015; Günther *et al.*, 2017; Rana *et al.*, 2023). As a consequence, academic literature has emphasised their "disruptive potential" for enhancing corporate sustainability performance (Etzion and Aragon-Correa, 2015), creating more equal and inclusive society (Secundo *et al.*, 2017), fostering optimal reallocation of underutilized resources (Etter *et al.*, 2019) and enabling more participatory and democratic forms of governance (Neu *et al.*, 2019; Ojala *et al.*, 2019; Uldam, 2018).

Conversely, the advocates of the critical approach have raised concerns about digital technologies related to privacy and security threats (La Torre *et al.*, 2018), limitations of autonomy and freedom (Andrew and Baker, 2019), labour exploitation (Fuchs, 2010), lack of algorithmic accountability (Martin, 2019), pervasive worker control (Chai and Scully, 2019), and ecological footprint (Corbett, 2018; Lucivero, 2020). Hence, the magnitude and pervasiveness of ethical, social and environmental risks that emerge as a consequence of user data collection, storage and algorithmic processing are imposing additional responsibility upon data processing companies. To this end, the extant literature offers three main reasons for why large technology companies still lack accountability for these consequences. First, the problem resides in the inherent power asymmetries between the companies and individual users that pre-empt the latter from holding the former accountable for their wrongdoings (Rosenblat and Stark, 2016; West, 2019). Such quasi-monopolistic concentration of power in the hands of internet corporations is exerted not only vis-a-vis individual consumers but also other organisations (i.e., suppliers, competitors) whose business survival depends on the services of the large companies (Flyverbom *et al.*, 2019). Second, regulatory efforts in the data economy often take place post hoc (Nunan and Di Domenico, 2017) and do not adequately address the contemporary issues of digitalization (Royakkers *et al.*, 2018). Until recently, a self-regulatory regime prevailed in technology regulation based on "soft" voluntary standards and principles which the large companies devel-

oped for themselves. Finally, wrongful practices become pervasive to the extent that the other actors take them for granted and stop questioning them (Ananny and Crawford, 2018).

As a result, companies find themselves in a "dual" position in which they simultaneously need to harness the potential of BDA to generate economic and societal value on the one hand, while at the same time are required establish an effective mechanism for ensuring accountability for the negative consequences of data utilization on the other. Hence, from the accounting perspective, this raises three important questions as to (1) whether accounting scholars can explain the emergent issues with BDA using established accounting theories, (2) whether and, if so, how the processing of BD results in calls for wider organisational accountability and greater regulatory oversight and (3) how the value of BDA can be assessed from a financial accounting standpoint. The present manuscript aims to address these questions.

Chapter 1 "Emerging technologies in accounting" reviews technologies that underlie the use of BDA in accounting, provide definitions, discuss their interdependencies and explain differences between different technologies, illustrating their current and potential applications. In particular, new sources of big data and their characteristics will be discussed; different analytical approaches will be reviewed. The principal goal of this chapter is to establish a clear terminology and introduce key concepts that are fundamental for understanding the role of BDA in accounting.

Chapter 2 "Peculiar and established theories framing studies of BDA in accounting" examines whether and how accounting literature has rooted BDA issues inside theoretical frameworks in order to formulate new concepts and models, to support the adoption of further methods and approaches, to explain and root the solutions used in practice.

Chapter 3 "Data Regulations in the European Union" provides the most recent overview of the legal frameworks and regulatory developments in the European Union with regards to the data collection, use, storage, processing and sharing. Starting with the General Data Protection Regulation (GDPR) implementation in 2018, the European Union is taking a pioneer role in data-related regulations globally, imposes greater obligations, stricter rules and accountability frameworks. The chapter provides business and competitive context to explains the nature of the problem each regulatory initiative seeks to address, provides a general overview of the legal provisions in the context of the theoretical research in law, information systems and accounting and concludes by critical assessment of the effectiveness of the regulation – enforced or proposed – in reaching its goals and formulates a series of recommendations for potential improvement.

Chapter 4 “Assessing the Value of Big Data and Analytics: Issues, Opportunities and Challenges” assesses the value of data that derives, rather than from inherent conditions, from the possibility of generating insights and the actual use of the same (Ferraris *et al.*, 2019; Günther *et al.*, 2017).

“Conclusion” summarizes key research findings useful to provide answers to the above listed three research questions.

1.
Emerging technologies in accounting

Big data analytics (BDA) facilitates data collection, processing, information delivery and managerial decision making (Sardi *et al.*, 2020; Bhimani and Willcocks, 2014; Rikhardson and Yigitbasioglu, 2018). Traditionally, companies used to collect financial and non-financial data generated as a result of customer transactions or recorded as a by-product of their ongoing operational activity. The data was intentionally collected by companies for known purpose, organised in a tabular form, and stored on local servers. Information delivery implied reporting of past results which were analysed periodically; analytics was predominantly descriptive in nature and oriented towards the past. By contrast, digitalisation has unlocked new data sources (social media, Internet-of-Things), collection (mobile connectivity, online platforms), storage (cloud-based infrastructures), processing (artificial intelligence and machine learning) and information delivery (real-time interactive dashboards and sector-specific software) capabilities.

However, BDA does not exist in isolation. Instead, it is enabled by the ever-increasing use of connected mobile devices and automatic data generation by means of exchange between connected devices and human online interactions on social media platforms, underpinned by advanced network infrastructures, supported by cloud-based data storage, processing and computing, and analysed by advanced machine learning algorithms. Therefore, before turning to theorizing about BDA, reviewing its regulatory developments and managerial implications, it is important to identify technologies related to BDA and clarify the relationships between them. Doing so will establish a common vocabulary and provide a clear set of technology-related terms which can be drawn upon when discussing their implications for accounting theory, regulation and practice. The following terms are reviewed: (1) mobile and connectivity, (2) big data, (3) artificial intelligence and machine learning, (4) cloud, (5) data security, (6) Internet-of-Things, and (5) online platforms and social media.

Mobile is an umbrella term used for the family of technologies that run on

portable devices that are equipped with wireless connectivity capabilities. Mobile connectivity allows their users to access, send and receive data and information without being restricted to a particular physical location. The ubiquity of mobile devices opens new opportunities for continuous data collection and gaining valuable consumer insight as well as information on operational efficiency and workforce performance but also creates additional risks for privacy and security.

Big data (BD) is a term that defines complex and extremely large datasets that emanate from multiple, different sources and require advanced capabilities for collection, storage and processing because of their volume, variety and velocity. BD comes from three major sources: (1) data recorded as a result of operating activity of an organisation (e.g., transactional data), (2) data generated by individuals as a result of their online activities (e.g., social media posts) and (3) data generated automatically by connected devices (e.g., machine-generated data in smart devices) (Andrew and Baker, 2021). What distinguishes BD from other organisational resources that it can be shared and reused by multiple businesses simultaneously or sequentially without diminishing its economic value (von Ditfurth and Leineman, 2022). **Big data analytics** (BDA) refers to the process of extracting useful information from the BD using advanced algorithms.

Artificial intelligence (AI) encompasses a range of "intelligent" algorithms that are capable of learning and improving their performance over time. AI systems learn from the input data: the more observations are fed into the learning algorithm, the better the system gets at predicting a particular outcome. A distinction is often made between code-driven and learning-based AI (Smuha, 2021a). While both are based on algorithms, the former includes rule-based techniques that instruct the algorithms "top-down", the latter AI systems – referred to as **machine-learning (ML)** – rely on large amounts of data to 'learn' patterns in data and improve automatically by learning through experience (Smuha, 2021a). Because the ML algorithms learn autonomously, they are referred to as opaque "black-boxes" that are prone to amplify bias in the data and produce discriminatory outcomes which are not detectable by human intervention.

Cloud relates to the hardware and software capabilities (e.g., servers, storage, networks) provided "as-a-service" over the Internet by third-party suppliers such as Amazon Web Services or Microsoft Azure. BDA requires a powerful IT infrastructure and sufficient computational power to analyse large, unstructured datasets and deliver results in real-time. Relying on cloud technology results in significant cost savings as it reduces the need to make large IT capital investments and eliminates the costs of maintenance and local storage but raises questions about excessive dependence on the cloud service provider and raises security concerns (Yigitbasioglu, 2015).

Data security breach incidents can be categorised using confidentiality, integrity and availability (CIA) triad (La Torre *et al.*, 2018). *Confidentiality* refers to the ability to protect personal information from being viewed or accessed by an unauthorized party. An example of confidentiality breach occurs when personal data is revealed to the public. However, the original data remains intact and in full control of an organisation that stores it. *Integrity* refers to the ability to protect the personal data from being modified or deleted without authorization. Data integrity violations may occur as a result of intentional external security attacks (La Torre *et al.*, 2018) as well as undesirable actions by authorized personnel (Nunan and Di Domenico, 2017). The example of loss of integrity is when personal data records are altered, and the damage is exacerbated in situations when the fact of data tampering is not immediately apparent to the user. Finally, *availability* refers to the ability to provide continuous access to data. Availability may be comprised because of the power outrage, data theft or malicious attacks. As a result, it becomes impossible to retrieve personal data (Arkhipova and Vaia, 2018).

Internet of Things (IoT) refers to a connected network of "smart" devices – consumer electronics, industrial equipment, etc. – that can receive, send and exchange data over the Internet. Such devices are embedded with sensor technology, network connectivity and software applications and can be remotely controlled by a human or interact with one another automatically. As physical products become commoditised, gaining access to IoT-generated data to create better offerings and new data-driven business models is imperative for creating and sustaining competitive advantage.

Platforms connect distinct customer groups in two- or multi-sided markets and provide an intermediation service that enables interactions between different types of user groups (Podzun and Bongartz, 2021). Platforms share a set of characteristics. First, platforms benefit from substantial scale economies and network effects that result in a quasi-monopoly power on the market (Podzun and Bongartz, 2021). Second, platforms act as a "dual agent" for both sides of the market which can lead to structural conflict of interest (von Ditfurth and Leineman, 2022). Third, platforms often exert full control over data collection on both sides of the transaction, which in some cases may lead them to compete with their own users. Finally, social media platforms have recently drawn attention because of algorithmic recommendations design which resulted in user preference manipulation and propagation of mis- and disinformation (Heldt, 2022).

In sum, BDA is underpinned by a set of complementary technologies and serves as an enabler for new business models and other technologies that build upon BDA.

2.
Peculiar and established theories framing studies of big data analytics in accounting

2.1. Introduction

This current era is considered the age of Big Data (BD), the impact of which has been considered disruptive to various organisations, industries and economies (Oesterreich and Teuteberg, 2019), and described using expressions such as "management revolution" (McAfee *et al.*, 2012), "the next frontier" (Manyika *et al.*, 2011) and "extreme velocity of change" (Bhimani and Willcocks, 2014). BD's economic power to transform and reconfigure the economy has been assimilated to the internet's advent (Agarwal and Dhar, 2014) because it has proven able to modify procedures, establish new businesses, facilitate market entry, attract new clients and alter social dynamics and users' skills (Lucas *et al.*, 2013). As described in previous chapters, the BD phenomenon implies that data are continuously generated at unprecedented rates and velocities across organisations of all types and industries (Mikalef *et al.*, 2018). Therefore, the collection, analysis and control of large and complex data sets resulting from such a variety of sources require advanced techniques and technologies (Chen *et al.*, 2012), generally called Big Data Analytics (BDA). BDA implementation is complex but useful for recognising insights and identifying connections from massive amounts of data to improve decisions and judgments (John Walker, 2014; Oesterreich and Teuteberg, 2019).

The revolution brought about by the advent of BD and the attention gained by BDA have also had an impact on accounting research, giving rise to new issues, opportunities and challenges (Griffin and Wright, 2015; Vasarhelyi *et al.*, 2015). On the one hand, from the opportunities' perspective, accounting research can be based on unconventional and innovative datasets providing further evidence and leading empirical archival research in accounting to advance to a higher level. This potential improvement is related to both the vari-

ety of data sources and the increased access to data sets (unavailable until recently) from governments and other institutions (Warren *et al.*, 2015). On the other hand, from the challenges' perspective, there still seems to be a lack of theoretical foundation and practical understanding of the value of BD and BDA for companies (Mikalef *et al.*, 2019). Indeed, there has been an increase in the number of companies deciding to invest in BDA, but the actions to be taken to create an objective value that can be measured and reported remain ambiguous and unsettled (Munir *et al.*, 2022). BDA implies a rethinking process about the nature and classification of reality, the methods implemented in research, the potential connections with information and the construction of knowledge. This represents a real epistemological revolution (boyd and Crawford, 2012) for which accounting is changing and will probably continue to evolve (Leitner-Hanetseder *et al.*, 2021; Napier, 2006). The BD epistemological revolution still needs to be investigated because the data-driven approach, which is currently implemented by most BDA studies, is exactly the opposite of the traditionally adopted scientific epistemological perspectives on accounting (La Torre *et al.*, 2018; McAbee *et al.*, 2017). The epistemological revolution has gone so far as to question whether data can ground and frame theory (Cong and Du, 2022).

Accounting theories have traditionally been used to formulate new concepts and models, to support the adoption of further methods and approaches and to explain and root the solutions used in practice. As explained above, the development and application of BD and BDA in accounting are quite recent phenomena. Indeed, recent years have seen growing attention paid to how BDA might change accounting (Bhimani and Willcocks, 2014; Chapman *et al.*, 2021; Quattrone, 2016; Warren *et al.*, 2015), but this area of research is still fragmented and at an early stage in terms of theoretical grounding, methodological diversity and empirical analysis (Frizzo-Barker *et al.*, 2016). The aim of this chapter is to contribute to the understanding of BDA development and application in accounting, especially by analysing its theoretical frameworks.

In this way, the work aims to illustrate the role of accounting in BDA development and answers the following research questions: Upon what theories are BDA accounting studies based? What factors determining BDA development are identified as fundamental by accounting theories?

The first part of the chapter, which is presented in the next paragraph, recalls and discusses traditional research and theoretical perspectives concerning accounting information systems and technology. The analysis approach adopted for their introduction, based on the three main levels (i.e., calculation, information and knowledge, in Varaldo, 1990), evokes the current evolution

adopted to address the revolution introduced by BDA. The second part of this chapter is based on an analysis of the literature using and relating to accounting theories. The chapter is carried out in light of established accounting theories; its aim is to contribute to the understanding of BDA's impact on accounting studies in light of such theories.

2.2. Accounting information systems and technology: traditional and innovative theoretical perspectives

The use of the term "informatics" (*informatique*) dates back to 1962, when it was introduced for the first time by a French informatics pioneer, Philippe Dreyfus. This neologism derived from the combination of two terms: 'information' and 'automatic', highlighting the attention paid by the first computer scientists and the role played by the design and construction of calculating machines for the production of information. Indeed, the French Academy defined informatics as the science aimed at the rational processing of information through the use of automatic machines, capable of supporting human knowledge and communication in the technical, economic and social fields. Similarly, Frizzi (1977) defined the discipline in Italy dealing with the automatic processing of information using computers as "informatics". Even though informatics as a discipline included research areas of a theoretical nature that were not strictly related to the use of the computer, it coincided with automatic data processing or what was referred to by Anglo-Saxon term as computer science (Vallerani, 1982). As early as the late 1960s, it was realised that the *ex-ante* design of computers was not sufficient in itself and also required adequate *ex-post* programming: programmes had to be written, understood, corrected and only then executed by machines. This progressively led to the argument that informatics "has little to do with computers" (Abelson and Sussman, 1996). Computers brought about a revolution in the human way of thinking and expressing thought: it was an epochal and profoundly innovative phenomenon, which involved the emergence of procedural epistemology. The IT revolution also affected accounting (Varaldo, 1990). New ways of data processing became an important object of investigations in accounting research and were considered instrumental for the tasks performed by an accounting function within an organisation, such as systematic collection of useful information, its rapid classification and storage, organisational control, evaluating effects of organisation choices on the business system as well as for guiding managerial decision-making choices (Frizzi, 1977). The development of accounting systems into modern computer processing, in particular, consti-

tuted a relevant technical-professional issue, which also had a major impact on the evolution of the accounting profession (Coronella *et al.*, 2019). In particular, accounting scholars explore the history of the predecessors of Excel spreadsheets which are widely used by accounting professionals nowadays (Schmidt *et al.*, 2020a, 2020b). Galassi and Mattessich (2014) trace the emergence of a spreadsheet back to 1961 when Richard Mattessich has first introduced the concept of the computerised spreadsheets for budgeting process simulation in his article in The Accounting Review (Mattessich, 1961) which has laid down a foundation for developing a spreadsheet-based computer program for macro-computers using FORTRAN programming language. In 1969, Rene Pardo and Remy Landau present an electronic spreadsheet application for budgeting (called LANPAR) used in companies such as AT&T, Bell and General Motors. The first commercialised spreadsheet application for Apple personal computer – named Visicalc – was developed in 1978 by Dan Bricklin and Robert Frankston and become a pioneer innovation that set an example for subsequent spreadsheet application development (Galassi and Mattessich, 2014). Multiplan by Microsoft (a precursor to Excel) and Lotus-1-2-3 by the Lotus Development corporation were introduced in 1982 and 1983, respectively. The two spreadsheet applications remained fierce competitors till the introduction of Excel by Microsoft for Windows personal computer in 1985, after which the demand for Lotus applications began to decline. While several competing applications were introduced in the market subsequently (Quattro Pro by Borland Corporation), over 90% of the spreadsheet applications belonged to Microsoft Excel which were continuously improved in terms of functionality in the 1990s (Galassi and Mattessich, 2014). This evolution started from the need to connect accounting with system dynamics in order to develop models capable of reproducing observed firms and simulating different scenarios from alternative decisions. In particular, Mattessich (1958, 1961) argued that, if managed appropriately, the budget can serve as the foundation for the firm's economic and financial development simulation. Accounting began to be considered part of the management science due to the mental effort made by accountants in absorbing the tools and techniques of management doctrine and incorporating them into their conceptual apparatus. This needed interaction between different disciplines (i.e., management, computer science and accounting) has traditionally been analysed through three main levels focusing on calculation, information and knowledge respectively (Varaldo, 1990).

The first phase of analysis (i.e., calculation) focuses on improving the accounting process through the efficiency of the machine. As early as the 1960s,

with the aforementioned introduction of information technology, businesses found themself operating in a context characterised by the increasingly widespread adoption of advanced technological methods and tools. The computer, and more generally the technologies, became tools to facilitate man's work: technical progress called for the incessant development of information processing and transmission tools considered capable of increasing the productivity of man's mental work and consequently generating significant changes (Saraceno, 1978). The Italian doctrine of accounting have experienced a certain influence from the American doctrine that promoted the mechanisation of routine within an organisation through monotonous and repetitive tasks resulting in reduction of labor costs. According to Frizzi (1977), mechanisation enabled streamlining, optimization and standartisation of administrative processes across an organisation and facilitated (also improving) the preparation of accounting documents both for internal and third-party use. Furthermore, mechanisation of administrative work allowed to obtain labor cost savings without incurring large-scale upfront and operating cost of innovations (e.g., a new plant). Notwithstanding these advantages, mechanisation also proved to have certain limitations. First, although mechanisation provided quantitative data for facilitating paperwork, it contributed little to improve and inform managerial decision-making. Second, mechanisation of a subset of administrative processes implied that some procedures have continued to be performed manually, inevitably resulting in human errors, subjective interpretations, manipulations and distortions. Finally, mechanisation of a limited set of procedures resulted in initial disillusionment of upper management as they realised that the full benefits of mechanisation can have been only achieved if procedures automatically interacted and were integrated with one another, thereby forcing managers to review their approach. The latter point supported the view that an efficient "system" of accounting information was not based on automation of individual processes but, instead, united automated procedures into a single structure. The same management processes aimed at determining and regulating business systems were progressively qualified by the scientific approach, the adoption of refined techniques and the use of sophisticated tools for calculating, processing and transmitting information (Caramiello, 1966). The aim was to provide useful data to decision-makers at all levels of the organisational hierarchy in a timely manner and in the most appropriate form to the organisation function for which it was intended (Frizzi, 1977).

Indeed, the second phase (i.e., information) concerns the finalisation of the data elaborated by the machine to the decision-making process, requiring data

evaluation with respect to the corporate objectives (Rugiadini, 1970). In this respect, the term 'data' refers to the set of facts that represent events relating to a company or its surrounding environment system before they are organised in an intelligible and usable form for cognitive purposes (Culasso, 2004). On the other hand, the term 'information' refers to a set of data processed to be used by the corporate decision-making process for different cognitive purposes. Data is the elementary unit of information and must be subject to elaborative or aggregative processes in order to be exploited in the decision-making process (Sciarelli, 1999). Information must be understood not as any news or data acquired in a mediated or immediate way, but as new knowledge obtained through communication or sought through a direct process of observation. In other words, not all data communicated or acquired constitute information, but only those among them that increase the wealth of knowledge of those who receive or search for them become such. Indeed, the word information comes from the Latin *in formare* and literally means to give shape to something that has no form. Therefore, information is essential in order to move from the availability of data to the making of a business decision. Every individual – at whatever level he or she operates in the enterprise – needs information input in order to be able to choose the most appropriate behaviour from the possible alternatives in their decision-making process (Rugiadini, 1970). For this reason, Italian accounting scholars have been traditionally interested in the cost, risk and legal implications of installing an accounting information system in organisations. First, Frizzi (1977) mentioned that accounting information system requires installation of an electronic system with certain technical features that allow good memory capacity and fast access time to information. Managers also entrusted the computer with the simulation of special equipment designs and carried out energy analysis or auditing to optimize the operations of high-tech industrial plants and avoid significant energy losses (Vallerani, 1982). Doing so constitutes a fixed cost per company, which will be expensed only in the medium term, after the set-up is completed and permits an adequate economic use of the system (Frizzi, 1977). To that end, the role of certified public accountants was crucial as they were approached by the clients considering to install the system and were tasked with analysing its costs and benefits, advising smaller and medium enterprises in particular (Vallerani, 1982). Moreover, an important topic relates to the security and proper functioning of information system and the costs associated with having an acceptable level of risk of the system. Chiusa (1987) distinguishes between physical and logical security of information systems. While physical security refers to defence against events caused by the nature and human actions that result in hardware destruction, damage or physical access

of unauthorized outsiders to computer infrastructure, logical security deals with events that result in alternation of programs, input data or archives, violation of confidentiality of information transmitted online. To contain these risks within acceptable limits, managers must adopt appropriate defence measures and perform cost-benefit analysis to identify the magnitude of the cost involved in developing and implementing a measure, compared with the share of losses it is capable of avoiding (Chiusa, 1987). In sum, safety must strike a balance with efficiency: any increase in risks related to information system and its increased reach or functionality leads to an increase in costs and, consequently, decreasing the economic viability of investments. Finally – and related to the earlier point – the progress of information technology is so rapid that it causes uncertainties and unpredictable reactions (Vallerani, 1982) which complicates creation of legislation in the technology domain. On the one hand, the legal norm must apply over time, and the legislators should perceive the future trends in the development of information technology in different areas, which is almost impossible both because of the speed of the transformations taking place and because of the law-making mechanism itself. On the other hand, if legislators wait for information technology to yield certain, predictable and stable results over time, there is no doubt that the resulting legislation will be developed and adopted too late (Vallerani, 1982). The "information perspective of accounting" has represented a debate rooted in the academic literature and has traditionally aroused great interest (Cilloni, 1998, 1999, 2004; Galassi, 1987, 1991, 1994; Vigano and Mattessich, 2007).

An integrated information system within an organisation should entail a continuous and coordinated flow of information, which must be collected, analysed and transmitted to all individuals operating in the organisational structure. The promise of an integrated accounting system has encouraged accounting scholars to envision posterior control over management performance and results to be replaced by real-time analysis, prediction and prevention of negative outcomes. As long ago as in 1977, accounting information systems were viewed as an informatics tool that would enable managers to make the most of available information, and use past information to guide future decision-making, anticipate possible problems and develop solutions in advance. They were initially considered in their instrumental sense as sets of technical means and organisational structure underpinning a process (Sackman, 1967). In this regard, accountants become the ones who know the new electronic tools of information processing, masters their language and uses the computer economically, regarding it as a new factor of production system (Frizzi, 1977). Accountants possess cultural and scientific preparation that allow them to be

very apt in capturing the insights generated by the information systems and understand their concrete implications for business processes (Vallerani, 1982). The range of applications and techniques have expanded and have become increasingly complicated and sophisticated over the years both in the area of computers (hardware) and programs (software). In particular, accounting application software and programs were developed for solving particular managerial problems such as simplified accounting, VAT compliance management, IRPEF compliance management, payroll processing, warehouse management, production control and techniques for budgeting (Vallerani, 1982). To that end, a certified public accountant was engaged by the clients in order to analyse costs and benefits of employing a computer-based information system in a company. In doing so, accountant started by defining the problem and the objectives that the information system was intended to achieve (e.g., automating warehouse management), analysed the existing procedures and the existing system, then examined and implemented the technical features and functionality of the new system, and finally advises in the practical implementation of the new system and for its maintenance and reliability. Moreover, accountants often assumed the role of a programmer who prepared a set of instructions in a given programming language (BASIC, FORTRAN) and then translated these instructions by a special conversion program that is supplied to the processor for the purpose of obtaining a set of processes aimed at achieving the managerial objectives (Vallerani, 1982). It is noteworthy that the chartered accountants in professional firms not only acted as advisors for the companies that used computer-based information systems but were also direct users of these systems which they used to apply special procedures such as drafting and printing of company reports (financial and non-financial) and to provide up-to-date information on civil and tax regulations to clients. Therefore, the combination of mathematical, economic and accountancy knowledge and business experience of chartered accountants enable them from the very start of information technology development – recall the punch cards and perforated bands – to understand and assimilate the problems of information technology and study their practical applications (Vallerani, 1982). In this way, accounting information systems have been conceived from the outset as systems that permeate the entire company and cannot be attributed to a limited portion of the organisation. Information is elaborated and used throughout the entire company, from the strategic top management down to the most operational levels. Given its importance, numerous definitions of accounting information systems have been provided in the academic literature, which have also reflected the evolution of the interaction between IT and accounting. Giving more emphasis to its content and purpose, the information system was