Meta-Digital Accounting in the Context of Cloud Computing

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INTRODUCTION

Technology has always dominated human society, and each stage of society's development has corresponded to a certain technological limit. Thus, the leap to overcome the technological limit of each era has been marked by a revolution. Examples of this are the development of the *steam engine*, in 1769, which marked the transition to the Industrial Age; and the first *electronic computer*, which was designed in 1937, constructed in 1944, and launched in 1946, marking the transition to the Cybernetic Era (Cornish, 2004). The evolution of information technology after 1970 turned information into a primary production factor alongside labor, nature, and capital. Consequently, at the end of the twentieth century, theory and practice in the field assimilated the concept of a new economy: the digital or Internet economy.

Accounting has been present in human society ever since the division of labor. Over time, accounting, which is the technique and science of accounts, has adapted to the technological level and the limits of each era, especially through the evolution of the alphabet, numbers, and writing.

When stone and clay were used for writing, they were found in the accounting memoirs, describing debts, claims, collections, and payments. Clay pads from temples such as Uruk, Nippur, Kiş, and Suruppak bear witness to this fact (Heilbroner, 1999; Lipin & Belov, 1962; Vlaemminck, 1956; Obert, 2011). The transition from using animal skin to using paper has led to significant progress in terms of accounting techniques. The invention of printing, in the first half of the sixteenth century, facilitated the popularization of the accounting science. Two centuries later, the Industrial Revolution found accounting ready to meet the information necessities imposed by the speeding up of the movement of production factors and by the needs of capital holders. Toward the end of the nineteenth century, accounting was revitalized in terms of its technique, from the perspective of new concepts and qualitative accumulations. To this effect, the United States imposed a rapid pace of modernization of accounting concepts and techniques in order to inform a wider range of accounting information users. The triggering of the cyber revolution, in the middle of the twentieth century, left its mark on developments in accounting at the beginning of the 1980s, when the average cost of electronic equipment became affordable to organizations that found themselves in the race for computerization, a characteristic of the first technological wave (Moschella 1995; O'Brien, 1999). The end of the twentieth century brought the need to assimilate the progress made by information and communication technology. In this new era marked by the digital economy, the literature explored the concept of digital accounting, which was specific to the digital economy.

Over the last 4–5 years, the most popular information technique has been *cloud computing*, which is a collection of information and communication technologies that essentially represents the materialization of J. McCarthy's idea of utility computing from the 1960s (Zhang et al., 2010; Parkhill, 1966). In this context, we consider that, through the assimilation of cloud computing technology into the organization, the concept of digital accounting can move to a superior level of macro-economic aggregation, which we call *meta-digital accounting.*

BACKGROUND

About Digital Economy

At the beginning of the twentieth century, Keynes (1930) outlined the contribution of new technologies to the stimulation of investment policies. This would

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become obvious 40 years later, when electronic computers began to make their presence felt at affordable prices, thus launching the race for computerization.

After 1970, information and communication technologies (ICTs) began to add value to the traditional assets specific to the Agricultural and Industrial Ages. Moreover, the coupling of ICTs with traditional technologies led to hybrid technologies that put forward so-called virtual assets. In this context, a new form of economic manifestation of information as a production factor made its presence felt alongside the three traditional factors: labor, nature, and capital.

In their turn, information technologies (IT) have allowed information flows to be modeled in numerical form, leading to a *new economy* based on the numbers "0" and "1," i.e., the two pillars of digitalization. This is why the *new economy* is also called the *digital economy*. In other words, *digital economy* is a concrete form of economic manifestation of *production and service flows dominated by digital technologies*, where associated information flows are functionally dependent on ICTs.

From a historical perspective, as Kling and Lamb (1999) affirm, the concept of *digital economy* was popularized by Don Tapscott (1996) in his work *The Digital Economy: Promise and Peril in the Age of Networked Intelligence*. Moreover, a thorough analysis of Don Tapscott's work shows that no clear definition of digital economy is provided, allowing us to understand that, in fact, we are dealing with a *new economy*, within which *businesses use IT to enable their operation and growth.*

After 2000, the literature (Bergeron, 2002; Eckes & Zeiler, 2003; Josserand, 2004) has used the term *digital economy*, defined by the networking of economic entities, by entities' flow and process digitalization, and by the creation and exchange of digital assets (virtual assets) against the background of physical extension and the development of the Internet as a master network. In this context, ICTs were considered (Zekos, 2005) to be "the key" of the economic engine, specific to the new, digitized economy.

About Cloud Computing

The concept of cloud computing as an Internet-supported business model was proposed by Eric Schmidt of Google during a conference on search engines in August 2006. After an analysis of the definitions of cloud computing, Vaquero et al. (2009) support the idea that it represents "*a large pool of easily usable and accessible virtualized resources*" that "*can be dynamically reconfigured to adjust to a variable load (scale), allowing also for an optimum resource utilization*." In their turn, Badger et al. (2011) of the National Institute of Standards and Technology (NIST) define cloud computing as being "*a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources—for example, networks, servers, storage, applications and services—that can be rapidly provisioned and released with minimal management effort or service provider interaction*."

Duncan et al. (2009) synthesize the *architecture* of cloud computing (Figure 1) into four *hardware layers*, *infrastructure*, *platforms*, and *software*, which, in their turn, providing three categories of services, as follows:

1. *Infrastructure*, under the name *Infrastructure as a Service (IaaS);*
2. *Platform*, under the name *Platform as a Service (PaaS)*;
3. *Software*, under the name *Software as a Service (SaaS)*.

The characteristics of cloud computing as a technological pole can be synthesized as follows (Badger et al., 2011; Mell & Grance; 2011, Harding, 2011): *on-demand self-service, broad network access, resource pooling*, *rapid elasticity,* and *measured service.* To these five characteristics, a series of descriptive characteristics (Winans & Brown, 2009) may be added: multi-tenancy, geo-distribution, ubiquitous network access, shared resource pooling, dynamic resource provisioning, service orientation, utility-based pricing, self-organization, hardware and software resource heterogeneity, hardware and software resource virtualization for consumers, high-quality services, automatic service scalability via self-management in real time, usability, and standardization.

DIGITAL ACCOUNTING IN CLOUD COMPUTING

Digital accounting can be defined as accountancy that is specific to the current digital economy (Deshmukh, 2006). From an evolutionary perspective, after 1970, accountancy has been the subject of technological pres-