

# Editorial

## Digital Accounting: The Challenges of *Blockchain* Technology for Academics and Professionals

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The editorial in this issue examines the emerging literature on *blockchain* technology in accounting and auditing. To this end, it presents a systematic review of publications in international journals and an overview of the first texts on this topic published in some Latin American countries. Furthermore, the editorial makes a survey of the journals that have addressed *blockchain* more closely, the mechanisms that link it with accounting and auditing, the impacts it will likely have, the areas proposed in the research agenda, and its relationship with cryptocurrencies, environmental accounting, and cybersecurity, among others. This is not a comprehensive survey, but an overview of the emerging literature. The conclusion raises the potential of this field for our region on the basis of some local publications.

The pandemic generated by COVID-19 has highlighted the trend towards digitization of accounting professional field. This was emphasized by several academics from Latin America, such as Cláudio Wanderley (Brazil), Gabriela Farías (Mexico), Kate Horton (Brazil), Natalia Cuadra (Chile), and Osvaldo Maldonado (Chile) in a collective article recently published in the British journal *Accounting Education* (Sangster, Stoner and Flood, 2020). According to this paper, Public Accounting students from Argentina, Chile, Colombia and, particularly, Brazil and Venezuela, had connectivity issues during the first semester of 2020; in these countries, however, and particularly in Argentina, progress has been made in making this type of infrastructure available to students. Argentina appears to be taking the lead in this matter.

But beyond the possibility and need to have internet access for training purposes, the accounting profession is moving towards the digitization of a significant number of its processes. This new stage was formally launched in Colombia through the Centre for the Fourth Industrial Revolution, created in Medellín in April 2019. This was the fifth of such Centres created internationally, as part of a network of the World Economic Forum; the other four are located in San Francisco (United States), Tokyo (Japan), Beijing (China), and Bombay (India). Initially, it focused on three activities: artificial intelligence, the Internet of things, and *blockchain* technology.

The fourth revolution, or industry 4.0, blurs the boundaries between the physical, digital, and biological spheres.

Artificial intelligence is a branch of computational science that studies computer models that are able to perform activities carried out by humans. Thanks to this “intelligence”, machines may perceive, learn, solve problems, interpret data, develop autonomous driving systems, have autonomy to interact in complex games, and recognize, among others, writing and voice patterns. On the other hand, the Internet of things refers to the digital interconnection of everyday objects, even without Wi-Fi or Bluetooth. It consists of connecting domestic, industrial, and personal devices with systems and services, linking physical objects and biological material through different types of virtual networks (Macias, 2019a). It goes beyond closed-circuit camera systems, sensors, cables, and Wi-Fi or Bluetooth signals, which are only the starting point.

But the component of the fourth industrial revolution closest to accounting is undoubtedly *blockchain* technology or “chain of blocks”. It is a structure of data (information) grouped together, which connected internally and with external data as well. This technology builds a reliable foundation for systems, and it is useful in those spaces where orderly information is stored over time, without being able to be modified and requiring safekeeping. It is also meant to verify the identity of those who interact on the networks, to monitor transactions (financial and otherwise), and to have multiple applications (Macias, 2019a).

*Blockchain* technology was introduced into accounting literature via special issues published in international journals. The first special issue on *blockchain* in accounting was published in 2017 by the *American Journal of Emerging Technologies in Accounting* (JETA) and the second was published in 2019 by the *Australian Accounting Review*. In the *Intelligent Systems in Accounting, Finance and Management journal*, five articles on this technology were published between 2017 and 2019, while in the *International Journal of Accounting Information Systems*, four articles on the same topic were published between 2018 and 2020. Several related topics, such as big

data, have been the subject of a higher number of special issues in accounting and auditing journals.

In Latin America, papers on *blockchain* technology in accounting and auditing are also being written. A group of professors from Argentina have written documents analyzing this topic as a new challenge for accounting and auditing (Argañaraz, et al., 2019) and also as an initial approach to the relationship between *blockchain* and accounting (Rodríguez and Sarro, 2019) . In Colombia, undergraduate jobs have begun to appear (Baquero and Prieto, 2018), as well as postgraduate studies in tax auditing (Castillo and Garcés, 2020; Pardo, 2020). Some graduation projects address the application of this technology in a wide number of business areas other than accounting.

The literature contains general recommendations for rigorous research on *blockchain* and a growing body of work related to its potentialities in accounting and auditing. One of the general works indicates that approximately a decade ago the fundamental operating principle of *blockchain* technology was introduced, but that several years elapsed before this technology gained wide recognition in the industry and in academic spaces outside the field of computing. It is still an emerging research topic, and systematically transferring industry experience to research agendas –for example, through case studies– would allow theories to be developed, as well as practical recommendations on how to benefit from that technology. In this short paper we are interested in presenting a first overview of the international research into the implications of *blockchain* technology for accounting and auditing.

## Brief Review of the International Accounting Literature on *blockchain* Technology

The introduction of *blockchain* technology into the accounting literature is quite recent. Out of the 28 articles available in accounting journals linked to Scopus, 19 (68%) appeared in just four journals. Those with the highest

number of articles are the *Journal of Emerging Technologies in Accounting* (five articles) and the *Australian Accounting Review* (five articles), followed by *Intelligent Systems in Accounting, Finance and Management* (four articles), and the *International Journal of Digital Accounting Research* (four articles). The rest of the papers were published in seven other journals linked to Scopus, with one or two articles each. All were published between 2017 and 2020.

Since *blockchain* technology only recently emerged as a research area, scholars have predominantly based their studies on professional literature, online sources, and reports published by early users of the technology (Schmitz and Leoni, 2019). In fact, there are several research papers that analyze the implications of this technology in the accounting profession (Karajovic et al., 2019; Smith, 2018) and that make an overview of current practices related to *blockchain* in large accounting companies, as well as of important milestones in the emergence of this technology (Kokina et al., 2017). The digitization of the current physical verification process will make it migrate into information systems based on this technological structure. This new state of things means that, although accountants will no longer be the central authority, they will continue to prepare the financial reports required by companies and regulators, influence policies such as the selection and accreditation of validators, and serve as validators of last resort (Tan and Low, 2019).

There is a consensus in the literature that the link between *blockchain*, accounting and auditing occurs via the open, shared general ledger (Cai, 2019; Coyne and McMickle, 2017; Kokina et al., 2017; Moll and Yigitbasioglu, 2019; O’Leary, 2019; Schmitz and Leoni, 2019; Tang and Tang, 2019). “Open information transactions” differ from traditional transactions, in which, generally, the two parties to a transaction are the only ones with information thereof. This emerging technology is making transaction information potentially available to others, and this has important implications (O’Leary, 2018).

However, there is no consensus on the expected impact of *blockchain* on accounting and auditing. Some authors suggest that it is a disruptive

emerging technology that will have a significant impact (Schmitz and Leoni, 2019; Wang and Kogan, 2018), will transform accounting and the profession (Tan and Low, 2019), and may even represent such a transformation as profound as that of the emergence and adoption of double-entry accounting (Carlin, 2019). In contrast, other authors suggest that this technology will cause no transformations in the exercise of Public Accounting or auditing over the next ten years (Tiberius and Hirth, 2019). According to an intermediate position, blockchain technology will cause auditing to increasingly evolve towards continuous auditing (Tiberius and Hirth, 2019), while affecting accounting in a different way than similar technologies such as big data or artificial intelligence (Moll and Yigitbasioglu, 2019).

Several articles make proposals for future research (Kokina et al., 2017; Schmitz and Leoni, 2019). One of them, published in the *Australian Accounting Review*, proposes a research agenda on *blockchain*. Schmitz and Leoni (2019) identify four themes to guide the research: 1) governance, transparency, and trust; 2) continuous auditing; 3) smart contracts; and 4) new roles for accountants and auditors. The same paper identifies the practical implications of *blockchain* on accounting and auditing professionals.

An article on smart contracts and *blockchain* was recently published in Brazil, in the journal of the National Association of Postgraduate Programmes in Accounting Sciences (ANPCONT, for its acronym in Portuguese). The article proposes a unified automatic taxation system on the basis of a case study on the use of *blockchain* and smart contracts (Rosa and Pelucio-Grecco, 2020). This is one of the first Latin American papers to apply *blockchain* technology in depth in one of the four areas proposed internationally for the research agenda.

The fusion of *blockchain* and smart contracts can transform auditing by automating workflows and improving auditing and reporting effectiveness. It is possible that in the near future financial statements may be audited using external auditing *blockchains* which incorporate intelligent auditing procedures: “External auditing *blockchains* have the potential to improve

auditing quality and reduce the expectations gap between auditors, users of financial statements, and regulators” (Rozario and Vasarhelyi, 2018, p. 7).

The first research papers published in international journals emphasize some of the advantages (Kwilinski, 2019; O’Leary, 2017; Wang and Kogan, 2018) and limitations (Karajovic et al., 2019; O’Leary, 2019) of the use of this technology in accounting and auditing. The advantages include: 1) high speed, easy to use online transactions; 2) accounts can be updated using smartphone applications; and 3) optical data recognition systems allow the automation of the entire process, starting from the introduction of primary documents.

Regarding the limitations of this technology, the most important is that of the feasibility to access information, given that part of the information contained in the cloud is private and is not accessible to *blockchain* tools (O’Leary, 2017; 2019). Likewise, flaws have been identified that prevent this system from making current accounting ledgers more secure and from being implemented as a financial reporting tool; furthermore, *blockchain*-based digital currencies only exist within said method and economic transactions are much wider (Coyné and McMickle, 2017). Key barriers to the adoption of this technology have also been identified (Wang & Kogan, 2018) and an inventory of concerns about the widespread use of this technology has been made (Karajovic et al., 2019).

Part of the literature is specialized in cryptocurrencies, with all its implications. On the one hand, the increase and continued implementation of cryptocurrencies has had and will have a disruptive impact on accounting, taxation, and the financial services industries, even though the uncertainty about how they should be kept track of for accounting and taxation purposes has not been solved (Smith et al., 2019). Likewise, this technology is an innovation that can disrupt traditional financial intermediation by creating new intermediaries with an element of inherent trust that makes intermediaries in some financial areas unnecessary (Cai, 2018). On the other hand, the literature claims that fair value accounting is the most relevant source of useful information for users of financial statements when cryptocurrencies

are acquired for investment purposes and scenarios are identified where they will be treated as (foreign) currencies, although regulators of the financial system do not consider them to be money (Procházka, 2018). Very practical documents have also been published that offer a guide on how to bring the relationship between *blockchain* and cryptocurrencies to school (Gomaa et al., 2019). In all of this literature, future interactions between crypto assets and cryptocurrencies are proposed, while making recommendations for academics and professionals.

*Blockchain* technology has also been applied to specific topics such as distributed carbon, supply chains, and cybersecurity. One of the papers proposes a distributed carbon accounting system that uses *blockchain* to strengthen the accounting systems of carbon assets management and emissions trading schemes; this would allow for the national emissions trading scheme and the management of carbon assets to be unified in a synthetic mechanism (Tang and Tang, 2019).

On the other hand, this technology makes it possible to determine more precisely the origin of physical goods in distribution chains, an issue that is difficult to determine when these chains have complex, interorganizational, and, sometimes, international structures. (Kim and Laskowski, 2018). With regard to risks or cybersecurity, thirteen risks have been identified for the implementations of information systems, three of them specific to *blockchain*: centralization of computing power, malleability of transactions and faulty or malicious smart contracts. In this regard, controls which are adapted to the different components of the ecosystem have been proposed to mitigate the identified risks (Canelón et al., 2019).

Finally, it should be stressed that opportunities are plentiful, as insufficient attention has been paid to these technologies and how they affect the daily work of public accountants and auditors. Research is urgently needed to understand the new types of accounting required to manage businesses in the changing digital economy and to determine the new skills and skills that accountants may need to master in order to remain relevant and add value (Moll and Yigitbasioglu, 2019).



## Opportunities for Latin American Accounting Academics

In addition to the opportunities already identified in topics such as auditing, accounting education, and taxation (Macias and Vivas-Fuentes, 2020), *blockchain* technology opens new paths for Latin American research, both at the regional level and in interaction with extra-regional settings. Locally, accounting journals must face the need to scrutinize trends in the accounting field (Alba, 2019) and face the context of uncertainty even beyond the pandemic (Alzate, 2020), since they have entered, after complex processes, into the world of digital scientific journals (Persson and Gutiérrez, 2019).

An important group of Latin American academics entered early on into international discussions on accounting within the framework of COVID-19. In addition to those mentioned in the first paragraph of this editorial, professors such as Alejandra Patiño (Colombia), Inés García Fronti (Argentina), Jim Zumztein Zimand (Venezuela), Mary Vera-Colina (Colombia), and Óscar Fernández (Argentina) have also entered into this discussion (Sangster et al., 2020). Cuban professors such as Luis Demetrio Gómez and Marisleidy Alba have also done it (Alba and Gómez, 2020). Increasingly, Latin American professors are engaging earlier in the international discussions of each subfield. There are many similar opportunities with *blockchain*, as Agustín Argañaraz, María del Carmen Rodríguez, and other colleagues from Argentina have shown. There are also other new fields full of opportunities, such as the Sustainable Development Goals (SDGs) (Correa-García, 2019).

*Blockchain* technology brings research opportunities for both professors and students. The characteristics of accounting research in countries like Colombia, in addition to opening opportunities for undergraduate students (Macias, 2018; Castaño, 2019; Patiño et al., 2016) and for those who have participated in Latin American congresses such as CONTAD 2017 and CONTAD 2019 (Díaz, 2019; Amigo, 2018; Lozano et al., 2018), is also an open space for those academics who have accessed high-level training in accounting (Macias, 2019b). Our invitation is to link to these processes,

which are emerging in international settings, to overcome, from research, the conservatism exhibited by companies (Pelucio-Grecco et al., 2019; Vázquez and Miranda, 2020). The road is full of opportunities.

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