Auditors’ Adoption of Blockchain Technology: A Study on Antecedents

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Auditors’ Adoption of Blockchain Technology: A Study on Antecedents

Completed Research

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Abstract

In this study, we examine the adoption of Blockchain Technology (BC) by auditors as BC has the potentials to fundamentally change the auditing industry. We first examine auditors’ knowledge in accounting and auditing, their experience in using accounting software, and their general knowledge of BC. We suggest that these factors have a positive impact on BC adoption intention. We also examine auditors’ judgments regarding the sampling size of transactions considering the materiality concept. Lastly, we consider the roles of auditors’ degrees of professional skepticism (PS), defined in professional standards as having a questioning mind and critically assessing evidence. We suggest that both materiality and PS have a negative impact on BC adoption. A survey is conducted among internal and external auditors to collect empirical data to test our research model. The study recognizes some crucial factors that influence auditors’ adoption of BC, providing guidance for research and practice.

Keywords

Blockchain Technology, Adoption, Auditing, Professional Skepticism, Materiality.

Introduction

Blockchain technology (BC) is an innovative way to keep track of information. Through the BC infrastructure, transaction data are shared and updated in real-time using computer algorithms without third-party intervention. Joint with other technologies such as big data and Internet-of-Things (IoT), BC can revise the ways companies share data and manage transactions. Additionally, it improves the product or service traceability, authenticity, and legitimacy. This technology can contribute to different economic expenses, especially decentralized currencies such as cryptocurrencies, smart contracts, and smart property. The disintermediation caused by BC is expected to occur in all sectors of the economy, predominantly in the finance sector (Mainelli and von Gunten 2014; Schatsky and Muraskin 2015; Swan, 2015, 2018).

BC has potential implications in the areas of financial reporting, assurance, and corporate governance (Sheldon, 2018). According to Rozario and Thomas (2019), external audit blockchain can improve audit quality and increase the relevance and reliability of financial statements. Advocates believe that BC has the potential to fundamentally change the accounting and auditing industry, changing the accountant’s role “from collector and aggregator to interpreter and analyst” (Dai & Vasarhelyi, 2017). Thus, auditors must understand how BC affects the operating environment to determine the effects of its use on a company’s financial reporting. At present, studies on the applications of BC in auditing focus on the exploration of its technical capabilities, but seldom address how auditors may adopt this technology. This leaves a gap in the literature as knowledge of the determinants of its adoption may interpret how BC can be used by auditors. This study addresses the gap by answering the research question: What factors influence an auditor’s intention to adopt blockchain technology?
Auditors’ Adoption of Blockchain Technology

From a rational decision-making perspective, a person’s knowledge and experience regarding new technology and its use context would influence the adoption of the technology. Thus, we examine three areas of knowledge that are pertinent to the adoption of BC: auditors’ accounting and auditing knowledge, their knowledge in accounting software, and their general knowledge of BC.

Also, we examine the impact of two crucial attributes in the auditing field. First is materiality. In accounting and auditing, the materiality concept is a matter of professional judgment about whether misstatements of a transaction could reasonably influence the economic decisions of company stakeholders regarding their financial options. We aim to associate between auditors’ consideration of the materiality concept and the adoption and use of BC; this is because traditional factors to include a material transaction that auditors have been using can be changed by considering new technologies such as BC. With BC, auditors can examine most of the company’s transactions (Austin et al., 2019), and by using analytical procedures, there are little needs for sampling. Therefore, we anticipate a negative relationship between materiality consideration and BC adoption. Materiality consideration can be reflected in other issues regarding adopting new technology such as new threats, trust in BC providers, and changes in the technology that affect the trust in it.

Second, the professional skepticism is an attitude that includes a questioning mind, alertness to situations that may signal material misstatement, and critical assessment of audit evidence (Hayes 2016; Hurtt et al. 2013; Nelson, 2009). Increasing sample size or even auditing 100% of records does not mean auditors will not exercise professional judgment to plan and perform an audit with professional skepticism. In the digital era and particularly with BC, understanding and testing controls are going to require more technical skills and knowledge, which is both a challenge and an opportunity (Frishammar et al., 2019). Professional skepticism will be considered critical to BC adoption and auditors need to provide assurance of this technology.

Both materiality and professional skepticism are important attributes of auditors in making judgments and assessments, but neither has been examined in the adoption of BC by auditors. We thus include both factors to understand their roles in driving BC adoption by auditors. Also, we examine whether the demographic factors would influence the adoption of BC in accounting and auditing. These factors include auditors’ years of experience, number of professional certificates, age, gender, education, among other factors.

**Literature Review**

BC is a distributed data structure, or ledger, in which transactions are recorded and verified instantaneously through consensus algorithms. These systems keep records of ownership and transaction timestamps, eliminating the possibility of digital copying and, thus, double spending. Each node on the network stores a copy of data in the blockchain, and by a consensus function, the transactions cannot be changed, which preserves the immutability of the chain (Farell, 2015; Chuen, Guo & Wang, 2017). This enables the instantaneous auditing of specific transactions. BC creates efficiency and alters accountants’ jobs over time (Kokina, Mancha and Pachamanova, 2017).

Despite that the BC is still in its early stages regarding accounting application, it can provide financial stakeholders with greater trust and transparency. In connection with the agency theory (Jensen & Meckling, 1976), BC can reduce agency problems. The use of this technology has growing beyond financial transactions; cases can be found in government, insurance, health care, and retail (Mougayar, 2016). Auditors should be aware of financial conditions for all entities that they give consultancy or assurance services. Despite that accountants are usually slow adopters of new technologies (Alsharari, Dixon & Youssef, 2015), BC is seen as an opportunity for accountants to be efficient in reducing risks and increasing the comparability within the entity and between entities. Improving the contractual relationship via BC is aligned with solving agency problems and information asymmetry.

Through BC and related technologies, auditors can examine all records instead of using conventional audits or sampling methods (Sheldon, 2018). Therefore, through new technologies, auditing and attestation work can be efficiently and accurately realized. BC, audit data analytics, and computer-assisted audit tools and techniques (CAATTs) can be used to perform valuable input in auditors’ work (Broby and Paul, 2017). The blockchain-related technologies such as artificial intelligence are still not adopted by auditors; this presents a challenge for adopting BC by auditors (Wolfond, 2017).
However, other factors influence auditor consideration of the BC use. The potential negative perception related to BC adoption may be due to the well-being of individuals, entities, and societies. The dark side of information technology (Tarafdar et al., 2013) is related to ethics, regulations, law, security, privacy, intellectual piracy, automation-induced unemployment, and technical vulnerability effects and implications. Also, the security benefits of the blockchain that render are ostensibly immutable are not fully reliable in an accounting setting (Goyne and McMichael 2017). Since blockchain is an evolving technology, auditors should be cognizant of the tradeoffs between becoming an early blockchain adopter versus using a proven and mature technology solution (Sheldon, 2019).

Using a public blockchain supported by few nodes could increase the risk of attacks; as few nodes could control much of the network. The interaction with the blockchain is still complex for the “average user”. Mastering the concepts of wallet, transaction, mining, among other technological factors requires some technical background. At the same time, Bitcoin has frequently been associated with a pyramid scheme or a fraud. Furthermore, cryptocurrency volatility, which sometimes is driven by media news, could scare the potential users of decentralized applications (Gatteschi, et al. 2018).

Bitcoin is considered as proof of the concept of the public blockchain and presents the vision of the technology creators. But, in accounting and auditing, BC uses are occurred through using permissioned, private, or hybrid distributed ledger. Through a non-public blockchain, companies can exercise more control over sharing information of operations (Dai and Vasarhelyi, 2017). In this paper, we focus on the use of blockchain in general and without distinguishing the technology type as public or private.

**Research Model**

**Auditors’ knowledge**

BC can be used as an audit trail, under traditional and nontraditional audit processes (Rae, 2017). It can be implemented in conjunction with traditional auditing procedures when introduced. Larger sized entities are introducing this technology to modernize their operations. The auditor must conduct tests of control to ensure that used technology is operating effectively and adequately; this is related to the assessment of the risk of material misstatements and to identify the suitable substantive evidence to use in auditing work. Accounting Data Analytics and insights from big data can afford added information to auditors and strengthen the auditors’ analytical procedures. Audit firms are likely to act as pioneers in driving forward innovation in audit processes to strengthen their competitive advantage, and to satisfy the users of financial reports who are keen about innovative technology (Gambier and Jeffrey 2016; Ziolkowski, et al. 2019).

The validity of information is an important factor for auditors in attestation activities. By using BC, each transaction can be traced and verified instantly and permitted automated audits with the standardization of the practice; and altering or falsifying the accounting records would be extremely difficult if not impossible (Woodside et al., 2017). Therefore, because of the immutability of data, this technology protects against malicious attacks and internal threats. It enables auditors to export data embedded in the blockchain, but they need to be prepared in this technology. The decrease in the needs for confirmation and verification of accounts, balances, and other financial statements items, accountants and auditors can focus on specialized accounting data analytics that includes spending more time on preventive design and testing (Stein, 2018), and auditors can shift from testing of transactions to testing of controls (Liu, Wu, and Xu, 2019).

Having information available for decision-makers does not assure effective decisions, as the information must be processed, analyzed, and made useful for decision-makers. The new vision of sharing information between entities enables accounting and auditing professionals to evolve regarding the transition from compliance-oriented activities to strategic business consultancy, amplified by BC, big data, data analytics, artificial intelligence tools, and other related technologies (Seasongood, 2016). Thus, the integration between different disciplines such as accounting, programming, mathematics, statistics, etc. will affect traditional auditing.

Because of the potential effects of BC on auditing work, auditors must make rational decision-making regarding its adoption. Three sources of information may be most pertinent to their decisions: accounting/auditing knowledge, knowledge and experience in accounting software, and knowledge in BC. Auditors’ knowledge in accounting and auditing allows them to consider the challenges in auditing activities...
and recognize potential values in using BC to address those challenges. A challenge frequently facing auditors is data integrity: how can an auditor determine whether the financial data is authentic and without any unauthorized modification? With BC, this challenge may be addressed taking into consideration its inherent risks. Other benefits of BC such as traceability and verifiability may also be interpreted if the auditors have strong knowledge in the auditing process.

Since BC represents an innovative technology in auditing, past knowledge, and experience with accounting software may also help auditors better understand the comparative advantages of BC. Traditional accounting and auditing software, from a trusted third-party, may still be evolved with enhanced security, privacy, and integrity features. Thus, there is a chance that existing challenges in auditing may be addressed by the existing software. But on the other hand, when those challenges cannot be fundamentally addressed by existing software due to its architecture and design (e.g., reliance of the third-party for trust and authentication), auditors may recognize potentials in BC.

The application of BC is still at its commencement stage, and therefore, acquiring knowledge on it would help auditors better understand its features and use and make a better judgment in its adoption. Knowledge in accounting rules, accounting/auditing software, BC and related technologies affect in parallel to assist auditors to make an informed decision about when and how to adopt BC. Therefore, we hypothesize:

**H1:** Auditor’s knowledge of accounting rules is positively associated with BC adoption intention.

**H2:** Auditors’ knowledge in accounting software is positively associated with BC adoption intention.

**H3:** Auditors’ knowledge in BC is positively associated with BC adoption intention.

**Materiality concept**

Accountants have the responsibility to inform investors about the material economic transactions and events (EY, 2014). The new forms of conducting business increase the need to inform companies’ stakeholders. This, in turn, increases the demand for narrative reporting and accompanying notes to the financial statements that challenge the traditional accounting and auditing reporting (Duska et al. 2018). Accountants can be held liable for not disclosing material economic obligations. Accountants and auditors need to be well trained about the new ways to conduct business and to establish adequate reporting quality, and use auditable performance indicators to reasonably substantiate the notes of the financial statements (Thompson 2018).

The increasing demand for narrative reporting and accompanying notes to the financial statements challenges the traditional accounting and auditing reporting (Thompson 2018). The purpose of an audit of financial statements is related to institutional theory and the agency theory; auditors are fiduciary who has the responsibility to provide information about their performance to the shareholders, and to the secondary users of financial statements. Not including material economic transactions that include contingent liability can be considered an agency problem. Other challenges may arise for auditors regarding considering off-balance sheet capital and how to capture them.

Because there are no clear rules of thumb to measure the materiality, accountants rely on their judgments regarding what information to include in the financial statements (Bernstein, 2001). To estimate the effect of an event on a company, accountants depend on their interpretation of the existing rules to report the event in the financial reports (Juma’h, 2019; Bernardi and Pincus 1996; Boatsman and Robertson 1974).

Auditors need to be well trained about the new ways to conduct business and to establish adequate auditable performance indicators to reasonably substantiate the notes of the financial statements. Accountants have different perceptions and beliefs regarding how to consider the significance or material economic events. Through the BC, accounting data analytics, and related technologies, auditors can audit 100% of records, and therefore, the importance of the quantitative materiality consideration and sampling technique decrease. We thus hypothesize:

**H4:** Auditor’s materiality consideration is negatively associated with BC adoption intention.

**Professional skepticism**

The professional skepticism (PS) concept has been defined in accounting literature (Cataldo et al. 2014; Hayes 2016; Hurtt et al. 2013). For example, Hurtt (2010) utilizes specific characteristics to define skeptics such as questioning mind, suspension of judgment, and self confidence that focus more on having and
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pursuing doubt than on a doubt direction. Auditors' preparation and experience might influence their level of PS. According to Bamber et al. (1997), auditors update their beliefs based on new evidence. The Public Company Accounting Oversight Board (PCAOB, 2014) also suggests that accountants increase their level of PS when sufficient evidence is not available regarding a transaction.

The professional auditing literature highlights the importance of PS in the financial statement audit (Kadous 2000; Mautz and Sharaf 1961). Two views of PS have emerged from the literature: neutrality and presumptive doubt. In the neutrality view, auditors assume no bias on management’s representation, and in a presumptive doubt view, auditors estimate that bias on management’s representation may occur. PS is included in professional standards with little precision (Cohen et al. 2017; Nelson et al. 2005). However, in practice auditor should be skeptical about any issue that might affect the assertions in the financial statements or accompanying notes.

The level of PS, therefore, is a crucial factor in determining the adequacy of management decisions, which includes the adoption of new technologies (Allen, 2012; Gutierrez, Boukrami, & Lumsden, 2015). Auditors' degrees of PS influence their perceptions of needs for technology to be used in their work. The auditors' perception of the adequacy of new technology influence its adoption, for example, adopting BC can be associated, first, with the needs for shared database, multi-party participation, and resolution of trust issues, etc. and second, the perceived importance of BC features that include data structure, protection, and immutability, etc. We hypothesize:

H5: Auditor’s professional skepticism is negatively associated with BC adoption intention.

Also, we expect a direct effect of accounting knowledge on both materiality and PS. Materiality and PS are personal attributes that are built upon knowledge and experience in professional practices. For accountants and auditors, their knowledge and experience in accounting and auditing enable them to develop better judgments on financial events, improving both materiality perception and PS. Thus, we hypothesize:

H6: Auditor’s knowledge of accounting is positively associated with their materiality consideration.

H7: Auditor’s knowledge in accounting is positively associated with their professional skepticism

Demographic factors

As in finance and accounting behavioral research (See, for example, van Rooij, Lusardi & Alessie, 2011; Bezzina & Grima, 2011; Zheng, Xu & Wang, 2011), this paper considers demographic factors such as age, gender, education level, and income level, professional certificates, and years of experience. Some of these factors have been validated to influence, not only financial behavior in general (Yoon, Cole & Lee, 2009; Chong, Chang and Tan, 2014; Robb and Woodyard, 2011) but, specifically, accountants' and auditors' decisions.

Gender, age, education, and income level

Behavioral accounting and finance have evolved to explain the influence of psychology on the financial decision process, but not much is found to explain gender differences in the process. Evidence on gender differences in financial knowledge and risk preferences has been linked to financial decision-making. According to Powell and Ansic (1997), men and women adopt different strategies in financial decision making; however, these strategies do not affect their ability to perform. Differences in decision-making strategies may be affected by risk tolerance, level of confidence, financial knowledge, and investment objectives. Interestingly, men are found to be more aggressive, more prone to overconfidence and overreaction, have higher financial literacy and growth-oriented rather than income, while, women are less risk-seeking, less prone to overconfidence and overreaction, less financially literate, and more likely to invest for income rather than growth (Sadiq and Ishaq, 2014; Davar and Gill, 2007; Powell and Ansic, 1997).

As Endres, Chowdhury and Alam (2008) studied the effect gender had on financial decisions, they discovered men have a higher perception of their capabilities than women, men's personal goals are significantly more challenging than women's, and women are significantly more under confident than men. Men seem to show higher self-perceived ability in complex situations than women (Busch, 1995) and financial decision making (Jones and Tullous, 2002; Endres, Chowdhury and Alam, 2008). These findings could help explain differences in the decision to adopt BC by gender, as anticipated by the study.
In terms of age, Yoon, Cole and Lee (2009) suggest age interacts with other characteristics to affect the person’s fit and decision making. In their study on consumer decision making and aging, they found older adults show higher consumer experience and expertise which helps them make better decisions. Their finding is consistent with that of James, et al. (2012) that older persons with a high level of financial literacy exhibit better financial decision making, but, inconsistent with Lusardi’s (2012) who found low levels of literacy among the older population. Concerning education, income levels, and financial behavior, researchers argue income impacts knowledge: higher incomes are associated with more knowledge, and knowledge, at the same time, accounts for individuals making good financial decisions (Robb and Woodyard, 2011).

Experiences

Research in neuroscience and behavioral decision making has shown the significant role experiences play in forming risk preferences: according to Klement & Miranda (2012), the values, beliefs, and risk preferences of adults are shaped by their early experiences and impact significantly their financial decisions even more than demographic factors do. These findings are consistent with Lusardi (2003), who assesses people learn from and react to others’ experiences as well.

The theory of adaptive expectations suggests investors adjust, adapt, or form their expectations based on previous experiences and will learn from previous mistakes. It helps explain how experiences could be blamed to influence investors’ decision to adopt BC. Later development of this theory by Muth (1961) into the rational expectation theory explains how people form their expectations based on their best possible prediction of future outcomes.

The research model is shown in Figure 1.

Research Method

In the areas of behavioral accounting and finance, researchers frequently use surveys to collect data about individuals (Bodnaruk & Simonov, 2016; Brink & Rankin, 2013; Ehm, Müller, & Weber, 2014; Pang, Otto & Worthy, 2014). As we are studying auditors’ opinions about their knowledge, materiality concept, PS beliefs, and adoption intention, the survey is a viable approach to this goal. We conducted a survey on auditors in the United States to test the hypotheses empirically.

The survey items are adopted from the extant literature. The first section consists of items associated with general experience with BC; from this section, we aim to collect the participant’s intention to use BC. The items in section 2 are linked to the participants’ knowledge in accounting (similar to Cataldo et al. 2014;
Edgley, Jones, & Atkins, 2015; Leonardi, & Barley, 2010) and information technology (similar to Bloomfield, Nelson, & Soltes, 2016; Lee & Coughlin, 2015). The third section consists of items related to participants’ ability in performing their tasks as decision-makers (similar to Hayes 2016; Hurtt, 2010; Hurtt et al. 2013). The fourth section is related to participants’ awareness and proficiency in information technology. In the fifth section, we collect some demographic data of the participants and the firm where they work. All the manifest items of the research constructs are measured with five-point Likert scales (Strongly Disagree to Strongly Agree), and the demographic factors are each measured with a single item.

We used Qualtrics to distribute the survey. To avoid common method bias, we included two attention-check questions in the survey questionnaires. Participants who gave wrong answers to those questions were filtered out. From 350 invitations, we received 112 complete and usable observations, from which 56% are males and 44% are females. From the total participants, 85% indicate self-knowledge on BC (i.e., Agree and Strongly Agree to the measurement items) and 66% attended seminars or training of BC. Also, 52% and 61% of participants considered to use and intend to use BC, respectively.

Data Analysis and Results

Test of measurement items

We first tested the psychometric properties of the measurements. The reliability was tested using Cronbach’s α and Composite Reliability, and the convergent validity was tested using Average Variance Extracted (AVE). Discriminant validity was tested based on the comparison of the square-roots of the AVEs of the constructs and their correlations with other constructs. The results, shown in Table 1, suggest adequate psychometric properties of the measurements as reliability measures are in general over 0.7 (except for knowledge of accounting software which is 0.63) and AVEs are all over 0.5 (Fornell and Larcker, 1981; Nunnally and Bernstein, 1994). Further tests on cross-loadings did not show any issues, confirming the discriminant validity. Descriptive information of the research constructs is reported in Table 1 as well. Interestingly, the mean values of the intention to use BC is 52%, suggesting that the subjects generally perceive the need for BC and believe BC to be important for their jobs. We further tested the potential common method bias using the single-factor test and the latent method variance test, showing no concerns about the common method bias.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Mean</th>
<th>Stdev.</th>
<th>CA</th>
<th>CR</th>
<th>AVE</th>
<th>1)</th>
<th>2)</th>
<th>3)</th>
<th>4)</th>
<th>5)</th>
<th>6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Accounting knowledge</td>
<td>3.64</td>
<td>1.02</td>
<td>0.81</td>
<td>0.87</td>
<td>0.63</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) Acct software knowledge</td>
<td>3.66</td>
<td>1.09</td>
<td>0.63</td>
<td>0.83</td>
<td>0.72</td>
<td>0.36</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) BC knowledge</td>
<td>3.29</td>
<td>1.10</td>
<td>0.92</td>
<td>0.94</td>
<td>0.77</td>
<td>0.21</td>
<td>0.38</td>
<td>0.88</td>
<td></td>
<td></td>
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<tr>
<td>4) Intention</td>
<td>2.61</td>
<td>1.19</td>
<td>0.83</td>
<td>0.92</td>
<td>0.85</td>
<td>0.18</td>
<td>0.13</td>
<td>0.53</td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5) Materiality</td>
<td>3.46</td>
<td>0.86</td>
<td>0.69</td>
<td>0.81</td>
<td>0.52</td>
<td>0.62</td>
<td>0.18</td>
<td>0.10</td>
<td>-0.19</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>6) PS</td>
<td>4.21</td>
<td>0.77</td>
<td>0.96</td>
<td>0.96</td>
<td>0.77</td>
<td>0.33</td>
<td>0.21</td>
<td>0.01</td>
<td>-0.08</td>
<td>0.31</td>
<td>0.88</td>
</tr>
</tbody>
</table>

CA-Cronbach’s α; CR-Composite Reliability; AVE-Average Variance Extracted; values on the diagonal are the square-roots of the AVEs.

Table 1. Psychometric properties of the items and correlation matrix.

Test of hypotheses

Due to the small sample size (N=112), we used the Partial Least Squares (PLS) method to test the hypotheses. A popular PLS software package, SmartPLS 3.0 (Ringle et al 2015), was used. The bootstrapping procedure in SmartPLS was performed with 3,000 re-samples to test the significance of the path coefficients. The results show that knowledge in accounting and knowledge in BC both are positively associated with adoption intention, confirming H1 and H3. However, knowledge in accounting software is not significantly associated with adoption intention, rejecting H2. Materiality consideration has a negative association with adoption intention, confirming H4 and suggesting that materiality consideration will question the value of adopting BC in auditing. Professional skepticism is independent of the intention to adopt BC, rejecting H5. Finally, accounting knowledge has a positive association with both materiality and PS, confirming both H6 and H7. None of the demographic factors showed significance. The model explains 42.9% (adjusted R²) of the variance in adoption intention. The results are shown in Figure 2.
Discussion and Conclusions

This study provides empirical evidence of three antecedents to auditors' intentions to adopt BC: knowledge in accounting, knowledge in BC, and materiality. It also shows that knowledge in accounting software and professional skepticism does not have an impact on intention. This suggests that in future research and practice regarding BC-based auditing, researchers should focus on these factors to facilitate the adoption of BC. On the one hand, they may focus on measuring and even changing auditors' knowledge in accounting and BT, to communicate the benefits of BT. On the other hand, they should watch out for auditors' materiality perceptions, and potentially find mechanisms that may reduce its negative effect.

It is interesting to find that no matter how new technology such as BC affects the accounting profession, professional skepticism remains an important factor in conducting an audit. On the other side, with skilled-professional in new technologies, we expect to consider the materiality concept immaterial, perhaps, this is because auditors now can increase the number of audited records, and most likely they can audit 100% of the records, so there is no need for sampling. Also, accounting knowledge is an important factor to link auditing practices and blockchain technology.

Some limitations and future research directions may be recognized. We suggest further research to relate blockchain technology with other emerging technologies such as CAATT. Also, consider the big data and analytics that are supporting auditors to assess sample size, continuous monitoring, and artificial intelligence audit software. Finally, we suggest including non-technological forces such as the regulatory landscape.

In conclusion, IT investment is a crucial factor in know-how and concentration of core business. Accountants and auditors need to be trained in the new technology and how can they use it. Auditing firms need to move from conventional auditing to the optimized auditing using blockchain technology. In such a fast-paced technological environment it is important to continue considering the disrupting technologies such as blockchain to be effective.
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