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Opportunities, Challenges and Implications of Blockchain Technology for Accounting: An Exploratory Study

Abstract

Blockchain (BC) is an emerging technology that was first introduced in 2008 as the core technology behind Bitcoin. Now, its application extends far beyond the field of crypto-currency and finance to reach different businesses and industries, including accounting. The rapid growth of Blockchain Technology (BCT) is expected to impact the accounting profession and cause disruption in its ecosystem. Hence, the objective of this paper is two-fold: First, to shed light on BCT and analyze its opportunities, challenges and implications for accounting from an international perspective. Second, to conduct an exploratory study for the application of BCT in accounting in the Egyptian context. In doing so, this paper proposed a theoretical framework to theoretically analyze the application of BCT in the accounting field, viewing it as an integrated element in the accounting ecosystem. Moreover, an online survey was conducted using a questionnaire that was distributed among networks of accounting academics and practitioners in Egypt to explore their perceptions on the application of Blockchain Accounting (BCA). The results show that BCT offers many opportunities for the accounting profession, but it also entails some costs and challenges. It also has different implications for corporate reporting and auditing, as well as for accountants themselves, both in the national and the international context. This paper concluded that the rapid technological development is changing the way business is conducted, and in turn, accounting, as the language of business, will also face significant changes. However, the application of BC is still at its infancy, and it is not until its wide adoption that its potentials and implications can be revealed.

Keywords: Accounting, Auditing, Blockchain, Distributed Ledger Technology, Corporate Reporting

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فرص وتحديات وانعكاسات تكنولوجيا البلوك تشين على المحاسبة:

دراسة استكشافية

ملخص البحث

سلسلة الكتل أو (البلوك تشين) Blockchain هي تكنولوجيا ناشئة تم تقديمها لأول مرة في عام 2008 باعتبارها التقنية الأساسية التي تقوم عليها عملة البيتكوين Bitcoin، ولكن تمتد الآن تطبيقاتها إلى ما هو أبعد من مجال العملات المشفرة والتمويل لتصل إلى القطاعات والمهن المختلفة بما في ذلك مهنة المحاسبة، والتي من المتوقع أن يؤثر النمو المتسارع لتكنولوجيا البلوك تشين عليها ويسبب اضطراباً في نظامها البيئي. تهدف هذه الورقة إلى إلقاء الضوء على تكنولوجيا البلوك تشين وتحليل الفرص والتحديات والانعكاسات التي تحملها على مهنة المحاسبة من المنظور الدولي، كما تهدف إلى استطلاع رأى الأكاديميين والمهنيين في مصر حول تطبيق تكنولوجيا البلوك تشين في مجال المحاسبة. ومن أجل تحقيق ذلك، قدمت الورقة إطاراً نظرياً لتحليل تكنولوجيا البلوك تشين من منظور محاسبي، مع اعتبارها عنصراً متكاملًا في النظام البيئي المحاسبي، كما تم إجراء دراسة استكشافية من خلال استبيان تم تطبيقه على البيئة المصرية. وتشير النتائج إلى أن تكنولوجيا البلوك تشين توفر العديد من الفرص لمهنة المحاسبة ولكنها تنطوي أيضاً على بعض التكاليف والتحديات، كما أن لها آثارها المختلفة على المحاسبة المالية، وعملية إعداد تقارير الشركات، والمراجعة، وكذلك على المحاسبين أنفسهم. خلصت هذه الورقة إلى أن التطور التكنولوجي السريع يعمل على تغيير بيئة الأعمال، وبالتالي فإن المحاسبة، باعتبارها لغة الأعمال، ستواجه أيضاً تغييرات كبيرة، كما أن تطبيق تكنولوجيا البلوك تشين في مجال المحاسبة لا يزال في مهده، ولن يتم اكتشاف إمكاناتها وآثارها المحتملة إلا بعد تطبيقها على نطاق واسع.

الكلمات المفتاحية: المحاسبة، المراجعة، البلوك تشين، تكنولوجيا الدفاتر الموزعة، تقارير الشركات.

1. Introduction

Blockchain (BC) is a revolutionary new technology that was first introduced as the backbone behind bitcoin in 2008, and in a short time its application has extended to several fields and is now having far reaching implications for almost all industries and professions.

Blockchain Technology (BCT) is a decentralized data base that represents the next disruptive technology after the Internet, which is expected to influence all human activities (Pradhan 2018). BC represents the building block of the “internet of value”, as it enables for transactions’ recording and “value” transfer in a peer-to-peer network (World Bank, 2017).

Using BCT, a transaction between two parties is recorded in a distributed ledger in the form of a block in a chronological order that is time- stamped and contains “hash string”, which acts as a virtual fingerprint. Instead of data storage in a single location, BC allows copies of data to be shared across a massive, decentralized network which eliminates the need of a third party verification, reduces transactions costs, increases efficiency and transparency and enhances privacy and security.

The evolution of BCT has passed through several stages and its applications are developing in a rapid way. It started in the financial field then extended to other fields and industries (Mukherjee and Pradhan, 2021; Pradhan, 2018 and Swan, 2015). Different reports and publications suggest that the adoption of BC is increasing and sooner or later, it will be an integral part of many businesses (Deloitte, 2020a; Global Market Trajectory & Analytics, 2021; PWC, 2018; WEF, 2015 and Winter Green Research, 2018). This indicates that there will be a radical rapid change in the way businesses are conducted and many professions have to adapt to the disruption of the technological revolution including the Accounting profession.

From an accounting perspective, BC is causing a disruption and leading to a move to a new era of accounting and auditing. It gave rise to the term “Blockchain Accounting (BCA)”, which refers to an accounting system that

uses BCT. This new technology introduces a new way for organizing, recording, and validating transactions (McComb and Smalt, 2018), shifting from the well-known double- entry bookkeeping system to a triple- based reporting ledger that is based on cryptography and allows for automatic recording and confirmation of transactions in real time (Nalini 2018). Rather than relying on separate ledgers, companies use decentralized ledger to record their transactions, creating immutable and self-verifying records and leaving little room for fraud (ACCA Global, 2017, Founder's CPA, 2019 and Retchman, 2017).

As BCT becomes more mature, and its application increases across sectors and industries, it carries opportunities, challenges and implications for the accounting industry and ecosystem. Hence, accountants should be aware of the BCT as the companies they work for, or audit, will be adopting BC in some way or another (Markelevich, 2018).

This paper aims to analyze BCT from an accounting perspective and discuss its potentially disruptive impact on accounting based on a proposed theoretical framework. It sheds light on BCT and highlights the role of different players in the accounting ecosystem in response to the introduction of this technology. It also provides a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis and identifies its opportunities, challenges and implications for accounting from an accounting perspective. Moreover, this paper aims to explore the perceptions of the Egyptian academics and practitioners on the application of BCT in the accounting field through an online questionnaire .

This research aims to answer five main questions; (1) What is BCT? (2) What are the challenges and opportunities that BCT introduces to the accounting ecosystem? (3) How different players in the accounting ecosystem have responded to BCT? (4) What are the implications of BCT for Accounting? (5) How do Egyptian academics and professionals perceive BCA?

As BCT application in accounting is still in its early stage, this paper followed a theoretical analytical approach to answer the first four questions. The methodology of this paper is based on suggesting a BC accounting ecosystem framework, upon which, a theoretical analysis is made to the previous literature and publications by academics and practitioners to explore BCA, identify the potential disruption of BCT as well as its opportunities, challenges and implications for accounting. Moreover, this theoretical analysis was supported by an exploratory study to examine the perceptions of the Egyptian accounting academics and professionals on BCA using an online questionnaire.

This paper is organized as follows: After this introductory section, section (2) addresses the concept of BCT and highlights its potential opportunities and challenges from an accounting perspective. Section (3) represents the literature review, exploring responses of academics, practitioners, the Big Four as well as the regulators to the advent of this emerging technology. Section (4) presents the implications of BCT for accounting. Section (5) introduces an exploratory study on BCT in the Egyptian context. Section (6) presents results and discussion, while section (7) concludes.

2. Blockchain Technology: An Overview

2.1. What is Blockchain Technology (BCT)?

BCT is a revolutionary computer protocol utilized for recording and saving data on multiple computers (Deloitte, 2016). It can be described as a peer-to-peer, decentralized, distributed ledger that uses cryptography to record any transaction of value efficiently, and in a verifiable, immutable and robust way (Blockchain Council and WEF, 2018a).

BCT is characterized by distribution, encryption, immutability, tokenization and decentralization (Furlonger and Uzureau, 2019). Unlike traditional centralized databases, where all data is logged on single servers and all transactions are verified and kept by a central authority, BC databases are copies of ledgers held on all computers on the network without a need for

central authority or intermediary (Deloitte, 2016). Any participant can access information on the ledger, with no single point of failure, which creates trust in the system as a whole. Decentralized networks may be customized with respect to user access and usage rights. Blockchains can be public, private (permissioned) or hybrid systems (Akgiray, 2019; D’Atri *et al.*, 2019; Nascimento *et al.*, 2019 and WEF, 2018a).

BC network is composed of a group of computers called “Nodes”. When transactions occur, these nodes use smart contracts and cryptographic algorithms to confirm it and verify its validity, which is then coded and written into “blocks” and broadcasted to the rest of the network (D’Atri *et al.*, 2019 and Punga and Dutescu, 2020). Whenever a new transaction occurs, the network adds it as a permanent block to the chain (Singh, 2020).

Verification of transactions is obtained by the consensus of participants, replacing the need for a third-party authorization. These features make BC cryptographically secure and tamper-proof (WEF, 2018a). All the records in the network are immutable, time-stamped, encrypted and chronologically linked to each other (Punga and Dutescu, 2020). Figure (1) describes how BC works and how transactions are recorded, verified and added to the BC in the form of blocks.

Although initially known for its application in the financial sector, BC use cases include banking and finance, food safety, supply chain, retail, automobiles, government services, health care, insurance, energy, and real estate (Akgiray, 2019, McComb and Smalt, 2018 and Singh, 2020).

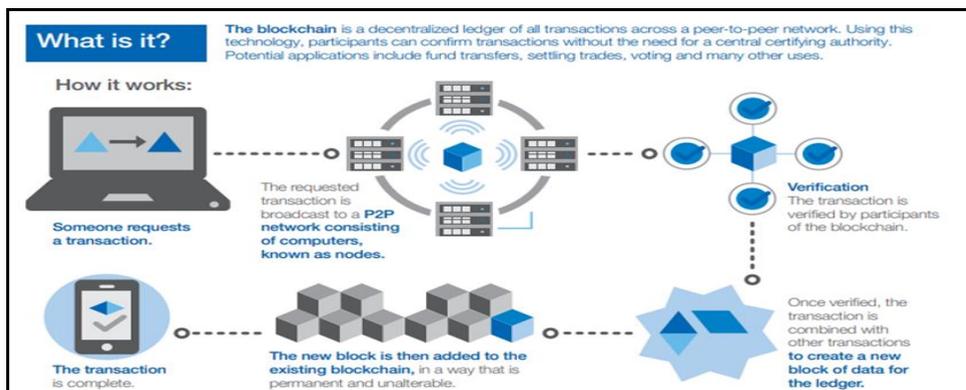


Figure 1: How blockchain works?

Source: WEF (2018a)

2.2. Blockchain Technology: An Accounting Perspective

Digital transformation raises challenges to the relevance of balance sheet data. Over years, the accounting profession has always responded to the technological advancements. The BC seems to be the new tool to be endorsed by the accounting profession (Appelbaum and Smith, 2018).

BC is regarded as a type of accounting technology that handles the transfer of assets ownership and keeps a ledger of accurate financial data. It affects how financial records are created, maintained, and updated fundamentally. It offers a kind of comprehensive accounting for accounting entries, and represents a massive spreadsheet for keeping track of all assets. It also functions as a global accounting system that can account for all different kinds of assets held by all parties around the world (ICAEW, 2018; Markelevich, 2018 and Potekhina and Riumkin, 2017).

Rather than recording and storing the transactions in a centralized ledger with access limited mainly to the accountant and auditor, using BC with its Distributed Ledger Technology (DLT), allows for recording of transactions in a distributed shared ledger, that can be accessed by different parties on the network based on public and private keys for authentication. Hence, each of the concerned parties including accountants, auditors, regulatory bodies, will always have an identical copy of the ledger (Martin, 2018).

BCT entails several benefits and opportunities for accounting. However, its application also carries some risks and challenges. Understanding the technology and leveraging the opportunities it offers will shape the future of the profession. This will be discussed below.

2.2.1 Benefits and opportunities of blockchain to accounting

The power of BC, with its DLT promises a wealth of advantages for the accounting profession. Table (1) represents the main features of BCT along with their application in accounting and their expected benefits and opportunities (Founder's CPA, 2019; Martin, 2018; McComb and Smalt, 2018; Sharma, 2018 and Yu *et al.*, 2018).

Table 1: Blockchain features, usage and opportunities to the accounting profession

Blockchain Features	Use in Accounting and Auditing	Benefits and Opportunities
Distributed Shared Ledger	<ul style="list-style-type: none"> - Each user of the BC (node) has a copy of the ledger and has access to the details of the transaction. - Companies can record all their transactions into a joint registry, rather than keeping multiple records. - There is no single point of failure. In case of failure in any node, the other nodes will continue to operate. - Multiple parties validate and question the input. 	<ul style="list-style-type: none"> - Consolidated bookkeeping - Higher transparency - Ensures information security - Increases information accuracy - Eliminates the need for reconciliation - Maintains the system's availability and viability - Increases auditability and trust - Eliminates third party - Lowers transaction cost
Real-time updating and distribution of information	<ul style="list-style-type: none"> - Transactions are recorded immediately (on near-real time). 	<ul style="list-style-type: none"> - Improved efficiency - Increased data accuracy - Reduced audit - Continuous auditing - Reduced paperwork - Eliminates the need for reconciliation - Real time analytical procedures
Digital and time-stamped (Hash)	<ul style="list-style-type: none"> - Transactions are recorded in the form of "blocks", with a digital timestamp and a unique cryptographic hash "fingerprint", which makes data fraud almost impossible. 	<ul style="list-style-type: none"> - Reduced fraud - Authenticated built-in audit-trail - Increased reliability - Increased security and trust

Consensus	- Transactions are not updated except after being verified by the consensus of network members.	<ul style="list-style-type: none"> - Reduced fraud - Increased reliability - Increased authenticity - Reduced audit - Offers a built –in audit trail - Eliminates the need for reconciliation
Immutability	- Transaction data recorded on a BC cannot be changed by a single user, creating immutable standardized accounting practices.	<ul style="list-style-type: none"> - Reduced fraud - Increased data security - Ensure authenticity of recording - Reduced audit - Simplified regulatory compliance - Standardized accounting practices
Smart contract	- The firms’ contracts are automated and shared within the BC in the form of smart contracts, coded to execute actions under specified conditions.	<ul style="list-style-type: none"> - Reduced human errors - Reduced audit - Easier reconciliation - Lower transaction cost - Increased transparency - Automated accounting and auditing functions
Differentiated levels	<ul style="list-style-type: none"> - Private BC allows organizations to customize user access. - It can also allow read-only access to external entities like regulators and auditor, which allows for near- real time transaction verification and more automated and quite continuous auditing. 	<ul style="list-style-type: none"> - Increased transparency - Offers audit trail - Real-time auditing - Continuous auditing - Reduce proprietary costs

Source: Compiled by the researcher and adopted from (Rao and Pandurangiah, 2018; and Appelbaum and Smith, 2018).

BCT is still in its infancy, and accountants are just trying to explore its potentials. As mentioned in the table above, BCT has many advantages for the accounting industry. The built-in audit trail makes the auditing process quick and simple in addition to the advantages of real-time recording, verification, and sharing of information.

Moreover, allowing the auditor, the client and related parties to exist on a BC network; each of them will have customized access to information. The network parties verify and approve the data as it is added, and once verified through consensus of different nodes, data recorded becomes immutable (Appelbaum and Nehmar, 2017 and Appelbaum and Smith, 2018). Moreover, a BC can be developed with a built-in, native audit trail. As there is a copy of the same ledger on all the network participants, there is no fear of

data loss. In case of the deletion of a block in one database, the other databases will automatically synchronize themselves, correcting the damaged database and undoing the deletion (Rechtman, 2017).

BCT also provides accountants the *opportunity* to act as BC advisors and join BC network. They are expected to spend more time on areas including technical know-how, and advisory related activities rather than on identifying errors and reconciliation work (Nalini, 2018). Moreover, as being experts in recording, bookkeeping, business logic and standards setting, accountants are best suited to master and influence the way BC can be embedded and used in the accounting field in the future, as well as in developing appropriate blockchain-led solutions and services (ICAEW, 2018).

There has been a growing interest in the application of BC along with other emerging technologies such as Internet of Things (IOT), Machine Learning (ML) and Artificial Intelligence (AI), especially after COVID-19, which has fueled these models (Wolfson, 2020). Hence, given all the above potentials and benefits, accountants have to get used to this emerging technology and the disruption it might cause, as it is expected to be a part of their daily workflow as it becomes mainstream.

2.2.2 Challenges, risks and limitations of blockchain to accounting

Although BCT offers a lot of benefits and opportunities to the accounting profession, it is still in an early stages of adoption and is associated with some risks, challenges and limitations which can hinder its mass adoption in accounting.

In general, PWC (2018) suggested that the biggest barriers to BC adoption lies in regulatory uncertainty, followed by the lack of trust among users, inability to bring network together, inability of separate BC to work together, inability to scale, intellectual property concerns, and audit compliance concerns. Furthermore, WEF (2018a) identified adoption challenges, technology barriers, legal and regulatory uncertainties,

interoperability, security risks and heavy energy consumption as the main six risks and challenges facing BC adoption.

From an accounting perspective, an emphasis can be made on the following BCT risks and challenges:

- 1) Most accounting software is incompatible with BCT. Companies will need to use cloud-based accounting services and customize their user interfaces until more BC accounting platforms emerge to meet the market needs (Martin, 2018).
- 2) The configuration of a BC system is still immature, hence, companies may face misconfiguration risks of access controls, processing, and storage integrity, which might constitute a barrier towards implementation (Rechtman, 2017).
- 3) Current BCT faces scalability challenge, where it has limited ability to process huge data and process transactions, which might not be able to handle the complexity of accounting information of firms, except with high costs to firms (Founder's CPA, 2019 and Yu *et al.*, 2018).
- 4) Validating the transaction through consensus of participants increases the authenticity of activities, but it also increases the time needed for transactions settlement (McComb and Smalt, 2018).
- 5) Although the DLT allows for information openness and transparency, it raises the problem of information confidentiality and increases the proprietary costs (Yu *et al.*, 2018).
- 6) Diversified and anonymous BC nodes makes it difficult to be regulated, which creates a risky environment. Moreover, some nodes can collude and add false information in the block. Also, transactions recorded on a BC could still be misclassified, unauthorized, fraudulent, or illegal, as firms can construct fake transactions to get the desired accounting numbers (Yu *et al.*, 2018).

7) There is no intermediary in case any problem arises and it is impossible to receive assistance in case of credentials loss (Gatteschi *et al.*, 2018).

BCA benefits, opportunities, risks, and challenges can be presented in the form of a SWOT analysis (Strength, Weaknesses, Opportunities and Threats), as shown in figure (1).

The use of BC can enhance the accounting profession as it increases efficiency and productivity and has the potential to enhance the trust between market participants (Yermack, 2017). Using smart contracts, companies can pull data from their financial statements to fulfill their contractual obligations and take required actions, hence, moving all financial reporting into the BC distributed ledger world can be a possible future scenario (FEI, 2018).

S	W	O	T
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> • Improved efficiency • Traceability • Accessibility • Decentralized data storage • Lower audit risk • Increased automation • Reduced errors • Easier reconciliation • Reduced cost • Reduced fraud • Improved regulatory compliance • Reduced audit • Security • Transparency • Immutability • Speed • No Intermediaries 	<ul style="list-style-type: none"> • Limited ability to process huge data • Technical incompatibility • Complexity • High energy consumption • Immature Technology • No intermediary in case of losing credentials • Risk of misconfiguration • High proprietary cost • High investment cost • Information confidentiality • Scalability • Privacy • Governance 	<ul style="list-style-type: none"> • Competitive advantage of early adoption • Creating new types of services • Integration with other technologies • Availability of huge amount of data • Platform of data analytics • Changings tasks and skills 	<ul style="list-style-type: none"> • Misconfiguration • Information confidentiality • Regulatory difficulties • Different regulatory frameworks for cryptoassets • Lack of awareness • Stakeholders resistance • Unsuitability for all existing processes • Low adoption rate • Lack of standardization

Figure 2: SWOT analysis for BC adoption in the accounting ecosystem

Source: Compiled by the researcher

On the other side, BC has some risks and challenges that need to be addressed before it leads to efficient application including its incompatibility, complexity, heavy energy consumption and environmentally unfriendly, privacy concerns, scalability issues and the lack of standardization and regulation.

As figure (1) shows, while BCT has some strengths and can introduce new opportunities, it also entails some weaknesses and can create some risks and threats. Hence, while BCT can have a positive influence on accounting and auditing and can optimize their processes, it is important to determine whether these benefits outweigh the costs and threats arising from its adoption and implementation.

3. Literature Review

Beyond the hype, BC is creating significant opportunities for almost every industry sector, including accounting. Although BC adoption in accounting is still in its infancy, it has gained much interest from academics, practitioners, and regulators, who are trying to delve into the potential of this new technology and the disruptions it might cause to the profession. The accounting ecosystem is composed of different players; each has responded differently to the introduction of BCT. Those players include academics, practitioners, professional bodies, standard setters and regulators. In a blockchain network, each of them can represent a node. This section discusses the responses of those players.

3.1. Responses of Academics and Practitioners

In the last decade, the potentials of BCT has received much attention from accounting academics and practitioners, where they attempted to explore the state of BCT and how it might impact the accounting profession, and the role of accountants and auditors in the future. The following will be a brief discussion of the previous literature in this area.

From an accounting perspective, early studies introducing this new technology and trying to explore its potential impacts almost started in 2016. For example, *Deloitte (2016)* suggested that BC may cause a disruptive change in the financial sector and enhance the current accounting practices. It pointed that as the double entry process has made a revolution in the accounting process, BCT can make another revolution and allow for the

creation of an interlocking system of accounting records, with verification made in an electronic way.

Later on, several studies discussed **the potential of BCT to change the accounting process and enhance corporate reporting and the quality of information**. For example, *McComb and Smalt (2018)* suggested that BCT is likely to cause disruption in the way information is recorded, organized, verified, and disseminated. They also discussed the current uses and potential applications of BCT that can likely enhance the accounting information timeliness, quality, and accuracy. Consistently, *Yu et al. (2018)* focused on the potential BC applications and impacts on financial accounting and auditing. They suggested that as a DLT, its characteristics of transparency, security and immutability enhance the trust between the market participants and reduce information asymmetry.

Karajovic et al. (2019) discussed how BCT will streamline accounting processes, especially as the technology becomes widespread. Moreover, they documented the phases through which BCT has been adopted in the accounting field suggesting that the true potential for BCT is still untapped. *Singh (2020)* explored how the XBRL standard can be used with new technologies, including BC in the financial reporting process to improve the production, audit, distribution, and consumption of information. He also assessed whether BCT could lead to efficient and effective consumption of data by analysts and investors. *Desplebin et al. (2021)* studied the potential impact of BCT on accounting systems, suggesting that the adoption of BCT will lead to the evolution and transformation of accounting and auditing processes and techniques, as well as the tasks, skills, and education of auditors.

Focusing on the potential auditing considerations, CPA Canada, and AICPA (2017) discussed the potential impact of BCT and suggested that auditors' roles and skills may change with the emergence of new BC- based techniques and procedures. Similarly, *Dai and Vasarhelyi (2017)* argued for a BC- based accounting and assurance methodology that allows for the disclosure of real-time verifiable accounting information as well as continuous

automated assurance. Additionally, *Kokina et al. (2017)* highlighted the challenges and opportunities of BCT and examined its application and current practices in large accounting firms. Moreover, based on a semi-structured interview with Deloitte, *Levenby and Sahlin (2018)* investigated the ability of BC to allow for a more reliable, cost-effective, and secure audit trail. The results showed that BCT has a lot of potentials, nonetheless, there is currently little understanding about it.

From a corporate governance perspective, Yermack (2017) discussed BCT potential implications on financial accounting, and its potential influences on financial accountants and auditors. More specifically, *Akgiray (2019)* suggested that BC enhances corporate governance in terms of transparency, accountability, responsibility, and fairness. Consistently, *Singh et al. (2020)* suggested that BC adoption can virtually improve all corporate governance aspects through enhancing efficiency, ensuring higher ownership transparency and mitigating fraud, as it provides an absolute audit trail as well as secure and accurate proxy voting.

Some studies provided insights into the potential of BCT using case studies, use cases or applications. For example, based on Design Science Research, *Appelbaum and Nehmer (2018)* focused on the audit issues faced in case of auditing BC transactions including data reliability, data security and transaction transparency in accounting systems based on BC. They also discussed how these systems can affect the assurance provided by the internal and external auditors, with relation to evidence standards and confirmations.

Hambiralovic and Karlsson (2018) analyzed BCA impacts on the firm and its key stakeholders, (auditors, banks, and tax authorities), using a case study of the Request Network, showing that the application of BCA by a firm has increased the automation of traditional accounting functions, reduced fraud and increased the reliability, credibility and usefulness of financial information. In addition, the roles and functions of some stakeholders could change from traditional services. Furthermore, suggesting a novel use of

BCT, **Sheldon (2018)** proposed an accountancy BC, where accounting professionals can join this network to share instance of practitioners misconduct in a country on a nearly real-time basis. He suggested that this accountancy BC will help key constituents work together, maintain transparency within the accounting profession and make practitioners responsible and accountable for their actions.

Wang and Kogan (2018) highlighted the possibility of creating a BC-based accounting information system to maintain the confidentiality of accounting. They also suggested developing a model to illustrate BC role in real time accounting, continuous auditing, and detection of financial fraud. **D'Atri et al. (2019)** discussed the potential of DLT in enhancing financial reports validation, storage and traceability, through a proposed BC based solution that enables the recording of all reports analysis activities and results on a shared ledger to guarantee their integrity and consistency. In doing so, they designed and implemented a prototype to validate and store financial statements using Ethereum BC, with the aim of increasing trust and transparency in published financial reports. They also performed tests based on financial reports of a set of Italian firms. Other papers that focused on BCT application from accounting information system perspective also include Coyne and McMickle (2017) and Alsaqa (2019).

Discussing the risks and challenges facing BC adoption, Bonson and Bednarova (2019) underscored scalability, flexibility, architecture suitability and cyber security as the main technological challenges facing BCT implementation. On the other side **Maffei et al. (2021)** provided a BC risk classification that helps in predicting negative consequences related to its adoption and creating a suitable “managing strategy”. Risk categories include security risk, operational risk, supplier risk and IT compliance risk.

Giving a more comprehensive overview, some studies conducted systemic literature review on the field of blockchain accounting. Cai (2018) focused on crowd funding and BC as two of the main fin-tech emerging innovations and suggested that both technologies have the potential

to disrupt traditional financial intermediation but in different ways. Moreover, **Schmitz and Leoni (2019)**, **Pimentel and Boulianne (2020)**, **Garanina et al. (2022)** and **Lombardi et al. (2022)** identified the main emerging themes of literature related to BC accounting conducted by practitioners and academics. Their results suggested that academic research lag behind practitioners' literature. Their results also suggested that BC will likely disrupt accounting and auditing, shifting their roles out of the back-office toward higher-profile advisory tasks. Moreover, **Tudor et al. (2021)** presented a hybrid systematic literature review for relevant studies that discuss how accounting organizations can manage the changes resulting from BCT application. They also conducted a SWOT analysis from the accounting and auditing firms perspective to support organizations assess their readiness for BC adoption and implementation.

From the previous literature, it can be concluded that BCT application in accounting and auditing is still in its early stage and most of the current literature is normative. The implications of this emerging technology on accounting are promising, but it can cause a disruptive effect on the roles and duties of accountants and auditors. However, still there is no adequate implementation of BCA to allow for drawing inferences and conclusions on what the future will carry to the profession.

This paper extends this line of research and tries to add to the literature that explores the potential of BCT and its implications on the accounting profession. It considers BC as a new element in the accounting ecosystem that can disrupt the profession and influences all the players in this ecosystem. Moreover, it supports this theoretical analysis by an exploratory study to analyze the perceptions of the Egyptian academics and professionals on BCT.

3.2. The Big Four Response to Blockchain

Believing that BCT is causing rapid transformation to different industries, and this will not leave the accounting profession untouched, the “Big Four” accounting firms; Pricewaterhousecoopers (PwC), Deloitte, Ernst & Young (EY) and KPMG are showing great interest in BCT, and each is having its

road map and perception towards its future implications and is making significant effort in understanding the market to help their clients integrate the emerging technology. They are also engaging in research and development on BCT and working on increasing audit efficiency and developing assurance tools through different initiatives (Kokina *et al.*, 2018, La Querica, 2018 and Young, 2018). A summary of the Big Four main contributions in the BC ecosystem is presented in figure (2), and a detailed discussion is presented below.

3.2.1. Pricewaterhousecoopers (PwC)

PwC is one of active professional accounting firms in the field of BC and crypto-assets (Young, 2018). It offers a comprehensive BC solution to its clients (Bhardwaj, 2016), as well as proprietary BC content covering the latest development in Fintech industry through its “*DeNovo*” Platform.

Early, in 2016, PwC started offering “*Vulcan Digital Asset Service*” to support digital assets usage in daily financial services and invested in *VeChain (VET)* network that uses BC to protect client brands and products (La Querica, 2018). It also launched its “*Digital Acceleration Program*” to train its employees in the area of BC and crypto currency. Moreover, in 2017, it backed “*Crypto Valley Association*” to support BC research and public policy outreach.

PwC also offers organizations guidance on designing, developing, and testing of BC solutions, in addition to providing third party integration assistance during implementation. It also released “*Blockchain Audit Service*” in 2018, allowing companies to obtain an external review of their BCT application. Alongside, PwC took the lead in accepting payment for its advisory services in *bitcoin* in Hong Kong in 2017 (Das, 2017). It also offers advisory services on crypto-funds, investments, crypto-currency exchanges, and Initial Coin Offerings (ICO).

However, PwC’s major concern is the regulatory uncertainty in the market. It believes that although considered to be tamper- proof, the

adoption of BC is facing some challenges, including compliance with companies and organizations and concerns about risk management and corporate control.

3.2.2. Deloitte

Deloitte is also playing an active role in the BC and crypto-currency field. It has been leading different initiatives to promote the application of BCT since 2016, with special focus on *the technical development and the implementation of this new technology* (Young, 2018).

Deloitte started working in its own BC in 2014. It has *partnered with several BC startups* and *presented over 30 BC prototypes* and is working on numerous BC oriented projects. It also launched *Rubix*, which is a “*one-stop blockchain software platform*”, largely based on BCT, and focusing on payments, rewards programs, and digital banking. It also diversified its services to include ICOs. Moreover, it also started offering *Digital Banking solutions* using BCT in 2016 (Bhardwaj, 2016 and Das, 2017).

In 2016, Deloitte installed one of *the first Bitcoin ATMs* in Toronto, and created “*Deloitte Blockchain Lab*” to support BC research and development. In 2017, it performed a BC audit, where it used the current auditing standards to examine a BC application (Das, 2017; Karajovic *et al.*, 2019, La Querica, 2018 and Young, 2018).

Deloitte suggests that BCT is approaching the breakout moment and highlighted scalability as the main challenge facing it, rather than its regulatory uncertainty (Young, 2018).

3.2.3. Ernst & Young (EY)

EY is also playing an important role in the BC space. It focuses *on BC legitimization, through risks identification of using blockchain-based platforms and crypto-related models, like ICO* (Young, 2018).

In 2018, it released “*EY Blockchain Analyzer*”, to facilitate review and analysis of transactions on BC by its audit teams, and gave rise to automated audit tests of BC assets, liabilities, equity, and smart contracts. EY also

launched “*EY Ops Chain*”, which focuses on pricing, integrating digital contracts, shared inventory information, invoicing, and payments. Moreover, it has also created a “*BC lab*” to help developing blockchain-based solutions for its clients. Moreover, it also launched an annual award to encourage developers in the crypto-currency market entitled “*EY Entrepreneur of the Year awards*”. It also focused on analyzing the public crypto-currency exchange market and highlighting risks involved in ICOs (Young, 2018).

EY followed a strategy for digitizing itself, which include accepting bitcoin. In 2016, it installed a *Bitcoin ATM* and offered its employees a digital bitcoin wallet. Moreover, in 2017, its branch in Switzerland was the first firm of its kind *to accept bitcoin payments for its auditing and advisory services* (Das, 2017). It also joined Bitcoin Association of Switzerland (BAS) as a corporate member and is currently working on developing the "Baseline Protocol", which is a project that runs on a public Ethereum main net (Wolfson, 2020).

3.2.4. KPMG

KPMG focuses on auditing, taxing, and analyzing BC integration. In 2016, it launched its “*Digital Ledger Service*” to help financial services companies in implementing BC applications, then joined *the Wall Street Blockchain Alliance (WSBA)* in 2017 as a corporate member (La Querica, 2018).

KPMG also works on *expanding its BC strategy to include tax, audit, advisory, and industries*, and creating comprehensive BC strategies and guidance (Young 2018). Moreover, it has also been involved in numerous BC projects and added a BC like ledger to its current line of consultancy services (Bhardwaj, 2016).

In 2017, KPMG created “*Blockchain Nodes*” in partnership with Microsoft, as a series of innovation workshops focused on the development of the technology, with the goal of creating and demonstrating use cases that apply BCT to business processes and propositions, and developing prototype

models to address BC implementation challenges in different sectors. It also introduced a BC maturity assessment model (ACCA, 2017 and KPMG, 2017).

KPMG also offers several BC-based software solutions, and its recent projects are principally related to identifying BC strategies, onboarding participants and developing governance as well as operating models, in addition to announcing a new patent for a BC-based method with the aim of increasing trust in AI data management practices (Wolfson, 2020).

Overall, the Big Four professional companies are playing a major role in tackling new market challenges. They have recognized the potential expanding market of BC and crypto assets, and beside their various initiatives to serve their clients' needs and develop their services and processes, they have also released several reports on BC and digital assets. For example, in its "Global Blockchain Survey", PWC (2018) showed that 84% of the respondents have at least some involvements with the BCT, with the financial services sector being the most advanced in developing BC, representing 46 percent, while KPMG (2019) showed that 79% of finance executives expect their auditors to have good understanding of the potential impacts of BC on their business or on financial reporting. Moreover, Deloitte's 2020 Global Blockchain survey, showed that leaders of organizations surveyed worldwide are increasingly considering BC among top- five strategic priorities. They believe that BCT is broadly scalable and can reach mainstream adoption (Deloitte, 2020a).

The Big Four and the professional bodies realized that the potential of BC is not limited to the crypto-currency domain but it extends to the digital transformation of enterprise business processes. Each of them has created its own approach to cope with the rapidly increasing interest in the BC space, either by shedding light on auditing for crypto-companies, or by working on building BC systems (Wolfson, 2020). PwC focuses on directly integrating BCT into its existing infrastructures, while Deloitte focuses on improving the technical aspects of this emerging technology. However, KPMG and EY

focus on analyzing BC implementation risks and developing tools that facilitates its implementation process (Young, 2018).

			
<ul style="list-style-type: none"> • DeNovo Platform • Vulcan Digital Asset Service • Vechain (VET) • Digital Acceleration Program • Backing "Crypto valley Association" • BC Audit Service • Accepting bitcoin payments • Advising services on crypto-funds, investments, crypto-currency exchanges 	<ul style="list-style-type: none"> • Partnering with BC startups • Presenting over 30 BC prototypes • Rubix- "One step BC software platform" • Exploring ICO • Offering digital banking solutions using BC • Bitcoin ATM • Deloitte BC labs • Performing BC audits 	<ul style="list-style-type: none"> • Legitimizing BC • EY Blockchain Analyzer • EY Ops Chain • Blockchain lab • EY Entrepreneur of the year award • Analyzing the public crypto-currency exchange market • Accepting bitcoin as a payment method for its services • Bitcoin ATM 	<ul style="list-style-type: none"> • Digital Ledger Service • Membership of the Wall Street Blockchain Alliance • Expanding the BC strategy into tax, audit, advisory and industries • Blockchain like ledger in the consultancy services • BC Nodes

Figure 3: The Big Four initiatives towards BC application

Source: Compiled by the researcher

In addition to the individual initiatives taken by each of the big four, a consortium for the key industry players is under formation, with the aim of collaboration, exploring ideas and addressing emerging concerns as well as examining potential opportunities associated with the application of this technology to the accounting industry (Karajovic *et al.*, 2019). The big four can act as a liaison between the BC and crypto- ecosystem and the institutional business world. Currently, they are already working with several BC and crypto firms on how to deal with the current BC challenges of regulatory uncertainty, interoperability and consensus models. They can lead in the application of public blockchains, and the rest of the market will then follow (Wolfson, 2020).

3.3. Regulators

The lack of regulation is one of the main challenges facing the wide adoption of BCT. As the application of BC started to take place in accounting and finance space, regulators started evaluating its impact. However,

currently, a comprehensive regulatory response to BC does not exist, with responses limited to issues related to BC components such as cryptocurrencies, ICOs and on specific legal issues such as Anti- Money Laundry (AML) and Know Your Customer (KYC).

While PwC (2018) highlighted the necessity to navigate regulatory uncertainties and the collaboration of BC developers with regulators and industry groups in setting emerging policies and introducing best practices, FRC (2018) suggested that BC by its nature, has the ability to enhance corporate reporting, and that reform and standardization of the current system could ultimately be more beneficial and would enable the eco-system to reap the benefits of this emerging technology.

In this respect, regulators can take one of three positions; ***Study-and-Wait-and-See***: where regulators attempt to conceptualize and understand the potential implications of BC as a new technology, ***enact new legislation and regulation*** or ***provide regulatory guidance*** on how existing legal frameworks can embrace new technologies, in addition to ***providing.... sandboxing*** opportunities to enable for the development of new models (Akgiray, 2019).

However, there is no agreement on the issue of BC regulation as applied in the accounting field. Opponents of BCT regulation claim that introducing regulations will impede the nature of this technology which will hinder recognition of its benefits, while, on the other hand, proponents suggest that regulators must enter the scene giving more creditworthiness to the system, prevent the possibilities of fraud or any illegal actions and face any dispute that might arise in the future from application.

4. Implications of Blockchain for Accounting

BC is expected to cause a fundamental gradual change to the accounting and auditing profession (Deloitte, 2016). Hence, beside exploring its opportunities and challenges, accounting professionals should also understand the implications of this technology and be ready for it. These include

implications for corporate reporting and financial accounting, auditing, as well as for the roles and skills of accountants.

4.1. Implications for Corporate Reporting and Financial Accounting

BCT is expected to have a great impact on corporate reporting and financial accounting especially in measurement, presentation, and disclosure of financial information, which reduces disclosure errors and earnings management, improves the information qualitative characteristics and reduces information asymmetry (Yu *et al.*, 2018). These implications can be summarized as follows:

1. The current system of corporate reporting is composed mainly of four elements: production, auditing, distribution and consumption. Applying BCT can enhance the reporting process through each of these elements. In the **“Production”** of accounting records, BCT can enhance the efficiency, timeliness, and reliability of error/tamper-free records as well as of the consolidation processes, with reduced earning management, but this is conditional on solving the problems of cost and interoperability. In the **“Distribution”** phase, using BC as a single source of credible, reliable and useable corporate data can be possible in case there are solutions that offer an ease of use. Furthermore, in the **“Consumption”** phase, BC can meet the needs of different users as well as the regulatory requirements, conditional on its wider adoption (FRC, 2018 and Singh, 2020).
2. BCT can enhance fair value accounting as it provides near real-time updated transparent and immutable information. The financial transactions will be reflected immediately and transparently on the balance sheet, which helps investors to make better informed- investment decisions based on real-time data (Shekar *et al.*, 2018).
3. BCT can also be used in capital markets, where everything is going to be transparent, eliminating the need for intermediaries. Trading of securities can be made in less time and cost. Potential areas of application also include

mutual funds, treasury and securities and managing funds (Shekar *et al.*,2018).

4. Crypto-assets, built on BCT, including crypto-currencies are an evolving, fast-growing asset class, that currently lacks clear guidance on accounting for them from the holder's perspective, which resulted in diversity in practice (EY, 2018). Accounting for crypto-assets shows three main financial reporting considerations; accounting for crypto-assets held by an entity, accounting for mining activities and accounting for ICO (Deloitte, 2020b). More work is needed in this area to cover different aspects of accounting for this type of assets.

4.2. Implications for Auditing

1. BCT can enhance efficiency, effectiveness, and reliability of auditing. Its features allow auditors to restructure the auditing process, procedures, and the evidence collection process. Continuous data flows enable all network participants to validate and receive real updates of transactions, allowing for more real-time, continuous audit testing. BC changes confirmations from being random to 100%, real-time and automatic ones, with higher probabilities to detect material errors, fraud, or financial irregularities. Also, inventory counts can change from being manual to continuous automated process based on advanced technology and electronic tags (Appelbaum and Nehmar, 2017; Appelbaum and Smith, 2018; ICAEW, 2018; La Querica, 2018; Sharma, 2018 and Smith, 2018).
2. BC can also increase audit activities effectiveness in certain key areas while reduce the need of performing existing audit procedures. For example, reviewing public ledgers and IT controls will be of more importance to the auditor, with higher priority given to soft skills, analytical abilities, and advisory services in providing more strategic value to the organization (Jernack, 2018 and La Querica, 2018).
3. Instead of spending much time on performing audits, auditors will spend more of their time in designing, reviewing, and verifying the flow of

information between systems and how transactions are recorded and recognized, in addition to how judgmental elements like valuations are made (ACCA, 2017; ICAEW, 2018 and La Querica, 2018). Auditors will also devote more time to focused analysis and risk areas that are more intricate, as well as to evaluating and testing internal controls and investigating discrepancies.

4. Using smart contracts, auditors will not only have access to real-time information, but they will also have access to the contracts underlying them, which further increases audit efficiency (Jernack, 2018).
5. Concerning audit risk, the change caused by BCT will lead to a decline in control risk but an increase in inherent risk. Accordingly, auditors will be much concerned with the reasonability and authenticity of the audited entity business rather than preventing major misstatements from accounting (Yu *et al.*, 2018).

4.3. Implications for Skills and Duties

The implications of BCT are not limited to the accounting and auditing processes, rather, they extend to the skills, roles and duties of accountants and auditors. These can be summarized as follows:

1. BCT will reduce traditional accounting jobs related to recording of transactions and preparation of financial statements, however, it will give rise to new jobs based on the assurance of source documents authenticity and smart contracts reasonability (CPA Canada and AICPA, 2017, ICAEW, 2018 and Yu *et al.*, 2018).
2. Future auditors will likely place more emphasis on data integrity, transaction sources, and smart contracts; as a result, experts will need to concentrate on evaluating high-level decisions and verifying the reliability of BC inputs (Founder's CPA, 2019).
3. Accountants' skills and mix of business, markets and financial knowledge enable them to be key advisors to companies approaching these new technologies and considering BC implementation (ICAEW, 2018).

4. Accountants can act as the link between IT specialists and business stakeholders. Moreover, accountants' expertise, either academics or practitioners can make a contribution in developing standards and regulations to cover BC (ICAEW, 2018).
5. Disputes arising between BC users may create the need of accounting arbitration by a certified professional accountant, especially with respect to smart contracts (Founder's CPA, 2019).

The above mentioned implications suggest that BC has transformative potential for the profession. It can likely alter some aspects of accounting, reporting, and auditing and improve internal control. It also has the potential to increase compliance, operational effectiveness and efficiency and achieve higher accuracy and reliability (Deloitte, 2020b). It will also change the duties, tasks and the skills required by accountants and auditors. Hence, accountants need to expand their skills, knowledge and understanding of the new technology as it will become a part of their (and their clients') daily workflow (Vetter, 2018).

5. Blockchain Accounting From The Egyptian Perspective: An Exploratory Study

After discussing the previous literature and analyzing the potential opportunities, challenges and implications of BCA from an international perspective, an online survey was sent out to capture the opinion of the participants of BCA ecosystem on the national level. An online questionnaire was distributed among groups and networks of Egyptian accounting academics and professionals who have good understanding of BCT, or IT professionals who have good accounting background to explore their perceptions on the implications of this technology for accounting in the Egyptian context. The survey was conducted between July and August 2023, in a form of questionnaire addressing questions on BCA in general as well as questions on the application of BCA in the Egyptian context, and resulted in 62 responses. The main results of the survey are presented and discussed below.

The survey results showed that most of the respondents believe that the accounting profession has always responded to the technological advancements in one way or another. The current knowledge of respondents ranges from being beginners to experts in BCT, with the majority having average knowledge. Most of the respondents got their knowledge on BCT from self-learning (71%). However, other sources of knowledge include lectures, seminars or training by their organizations (24%), webinars and online sessions by field experts and academics (31%), professional trainings and certificates (13%), while awareness and introductory sessions by national professional bodies representing only (10%). Other sources include partners and clients, and academic lectures in post graduate studies.

Regarding the general questions on BCA, table (2) presents the rank of different statements by level of agreement among the respondents.

Addressing questions on the potentials and opportunities of applying BCT, the majority of the respondents believe that BCT is suitable for application in the accounting field (77%), however, it will cause disruption in its eco-system (60%). Above 80% of the respondents believe that BCT adoption can enhance the accounting profession and the trust between market participants, and agree that it will improve the financial reporting process as it introduces a new way for organizing, recording and validating transactions, beside allowing for real-time recording, verification and sharing of information, and enhancing fair value accounting as it provides near real-time updated transparent and immutable information. Moreover, they agree that BCT can enhance efficiency, effectiveness and reliability of auditing and allows for continuous real-time auditing.

Most of the respondents also agree that big accounting firms can play a major role in the wide adoption of BCA worldwide and in Egypt and that large-size firms will find it easier to adopt BCA than small-size ones. However, they suggest that BCA adoption will require changes in the current accounting and auditing standards and regulations, enabling standard setters and regulators to join BC networks to better perform their monitoring role .

Additionally, BCT will change the role of accountants and auditors in the future, and hence, current skills of accountants and auditors might not be suitable for BCA adoption.

Table 2: Survey results - BCA: An overview

Statement	Mean	Std. Deviation	% of Agreement
BCT allows for real-time recording, verification and sharing of information.	4.07	0.820638	81.3
The adoption of BCA can enhance the accounting profession and the trust between market participants.	4.00	0.781133	80.0
BCT can enhance efficiency, effectiveness and reliability of auditing.	4.00	0.759125	80.0
BCT can allow for continuous real-time auditing.	4.00	0.882984	80.0
BCT will improve the financial reporting process as it introduces a new way for organizing, recording and validating transactions.	3.88	0.922261	77.7
BCT can enhance fair value accounting as it provides near real-time updated transparent and immutable information.	3.88	0.884742	77.7
The adoption of BCA will require changes in the current accounting and auditing standards and regulations.	3.85	1.022211	77.0
BCT is suitable for application in the accounting field.	3.85	0.953584	77.0
Large-size firms will find it easier to adopt BCA than small-size ones.	3.82	0.982761	76.3
BCT will change the role of accountants and auditors in the future.	3.73	0.954324	74.7
Big accounting firms can play a major role in the wide adoption of BCA worldwide and in Egypt.	3.63	0.990919	72.7
Standard setters and regulators can join BC networks to better perform their monitoring role.	3.63	0.822701	72.7
BCT will cause disruption to the accounting ecosystem.	3.02	1.228085	60.3
Accountants and auditor's current skills are suitable for BCA adoption.	2.40	1.152742	48.0

BCT is also associated with some risks, challenges and limitations. The survey results showed that respondents perceive legal and regulatory uncertainty (63%), lack of awareness (53%), security risks (52%), adoption challenges (50%), technological barriers (50%) as the top challenges of BCA. These are followed by risks and challenges of information confidentiality (39%), technical incompatibility (32%) and lack of standardization (27%). Other challenges highlighted include lack of training on the application of this new technology, economic constraints as it needs a lot of investment, interoperability between BC platforms, resistance from traditional institutions and lack of regulatory infrastructure.

On the other hand, with regards to the application of BCA in the Egyptian context, table (3) presents the statements sorted by respondents' level of agreement.

The survey results showed that the majority of respondents (84%) will support BCT and encourage its adoption in the accounting field if they better understand its potentials. Almost 82% suggested that more awareness and knowledge of the potentials of emerging technologies such as AI and BC is needed by including them in the undergraduate accounting curricula. Furthermore, academics and researchers have to collaborate with accounting professionals and IT specialists to better explore the best use cases of BCT in accounting. Moreover, accounting professionals need to adapt to the new business paradigm introduced by BC and expand their knowledge and skills to meet their client's needs.

Most of the survey respondents also believe that BCT will soon avail to the accounting industry and will be applied gradually to financial accounting and auditing. Moreover, they believe that BCT will change the way their organizations do business in the next 3 years and that the Big-4 accounting firms can lead the Egyptian market in the adoption of BCA, while the Egyptian Society for Accountants and Auditors (ESAA) can also play a major role in raising awareness and capacity building on the adoption of BCA.

Table 3: Survey results - Application of BCA in the Egyptian context

Statement	Mean	Std. Deviation	% of Agreement
I will encourage the adoption of BCT in the accounting field if I better understand the potentials of this technology.	4.18	0.873172	83.7
The potentials of emerging technologies such as Artificial Intelligence (AI) and BC have to be included in the undergraduate accounting curricula.	4.12	1.043002	82.3
Academics and researchers have to collaborate with accounting professionals and IT specialists to better explore the best use cases of BCT in accounting.	4.08	0.925929	81.7
Accounting professionals need to adapt to the new business paradigm introduced by BC and expand their knowledge and skills to meet their client's needs.	3.90	0.933374	78.0
The Egyptian Society for Accountants and Auditors (ESAA) can play a major role in raising awareness and capacity building on the adoption of BCA.	3.75	0.894901	75.0
The Big-4 accounting firms can lead the Egyptian market in the adoption of BCA.	3.68	0.911167	73.7
BCT will soon avail to the accounting industry and will be applied gradually to financial accounting and auditing.	3.50	0.911322	70.0
BCT will change the way your organization does business in the next 3 years.	3.35	1.102001	67.0

6. Results and Discussion

BCT represents a new area of expansion for accounting, where it has the potential to cause a radical change especially when applied with other innovations and technologies. In the digital transformation era and with rapid technological development, companies will find themselves operating in a new environment based on different business models governed by the power of technology that will revolutionize how businesses are conducted and impact how they can report on their activities.

Analyzing BCT from an accounting perspective, this paper suggests a framework for BC adoption in the accounting field. This framework considers BC as an integrated element in the accounting ecosystem that

includes different participants who can act as nodes in the BC network (Figure 4).

The analysis of the previous literature on BCA and the responses of different players in the accounting eco-system to its introduction supports a clearer view of the advantages, disadvantages, challenges and opportunities offered by this technology and enables for a SWOT analysis. It shows that the potentials of BCT have attracted the attention of the different players including academics, practitioners, large accounting firms, standard setters and regulators where all started to explore the features of this new technology and its challenges, opportunities and implications to the accounting profession.

BC reduces costs and increases efficiency because transactions are recorded in near real-time. This will enhance the role of accounting in interpreting the transactions' economic meaning and providing useful information for decision-making. However, it is worth noting that using BCT does not change the outcome of the transaction, rather, it changes the process. Many accounting and auditing processes can be optimized through the application of BC and other emerging technologies, such as AI, ML and data analytics, which have the potential to increase the accounting function efficiency and value (FRC, 2018 and ICAEW, 2018).

In conformity with Yu *et al.* (2018), this paper suggests that the application of BCT in corporate financial accounting can follow a gradual process in which companies will disclose their information on the BC network, while different stakeholders, representing BC nodes, will act as competitive miners and instantly record and validate information submitted by the firm. These stakeholders (nodes) might be *institutional investors* with technical and financial advantages who will be willing to have early access to corporate information, *intermediaries like auditors and lawyers*, where auditors can examine the source documents and have access to the smart contracts underlying the firm's transactions and even issue their audit opinion on the BC. Moreover, *regulators and stock exchanges* can represent important nodes in BCA network to play their monitoring roles.

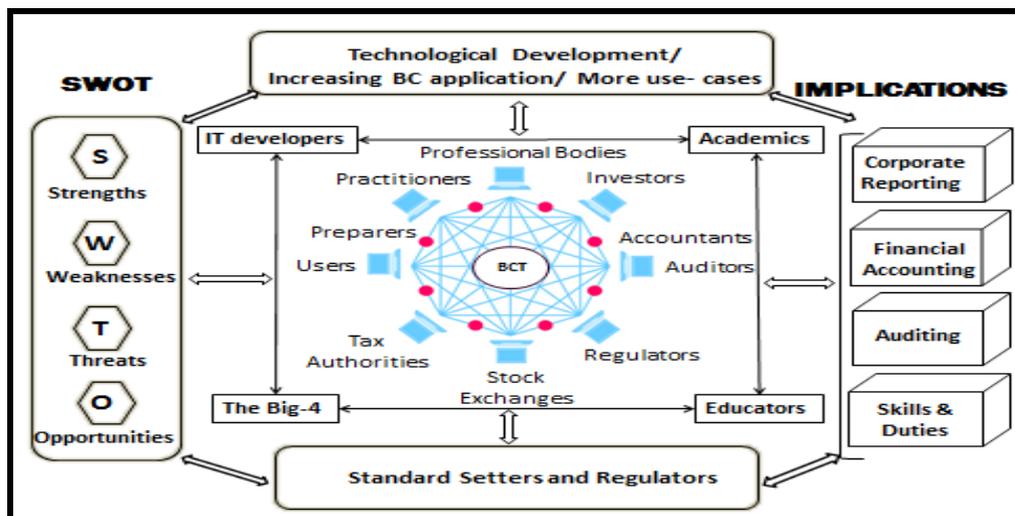


Figure 4: The Introduction of Blockchain in the Accounting Ecosystem

Source: Developed by the researcher

The proposed framework suggests that as the application of BC by organizations increases, its implications for the accounting profession will be more profound, inducing an increasing need for studying and analyzing the different aspects of this disrupting technology in the accounting ecosystem. As more use cases are adopted, companies will gain confidence in BCT and will gradually implement it in their core financial operations (McComb and Smalt, 2018). From an accounting perspective, standard setters and regulators have a crucial role to play in regulating and organizing some issues such as accounting for crypto-assets. Collaboration between different parties of the BC accounting ecosystem is also suggested.

As a result, it is expected that BCT will soon avail to the accounting industry and will be applied to financial accounting gradually. Initially, companies may start to make voluntary disclosure through the BC, while on the long run, as a wide adoption takes place and as financial statement preparers and users have more trust in this technology and recognize its potential, firms will be motivated to post transactions' source documents to the public BC, and through smart contracts, financial statements can be

automatically generated. However, the increasing amount of information disclosed on the BC will create a problem of comparability, creating the need for standardization and regulation to improve comparability (Yermack, 2017 and Yu *et al.*, 2018).

Ultimately, BC is likely to be a foundational technology that has potentially far-reaching implications for accounting and business, but, it will take time to be completely developed, standardized, regulated and embedded in the financial system and integrated in everyday functions of financial suite. However, it is important to note that adopting BC is not just a technological decision; but it is also a business decision (WEF, 2018b). BC application is suitable when it is solving real world problems, and where its benefits outweigh its cost (Akgiray, 2019; FRC, 2018 and Nascimento *et al.*, 2019).

Although the application of BCT in the accounting field has many proponents and a lot of potential advantages and opportunities are highlighted, there are also some opponents who suggest that BCT might not be best suited for the application in the accounting field or for financial reporting (Singh, 2020). BC application in corporate reporting is still in its early stage and might not be the best solution for many uses (FRC, 2018). Hence, before embarking on a BC project, companies should be sure that BC is the most appropriate solution. Moreover, decision-makers within an organization, should not be tempted by the hype, and identify whether applying BC is a sound business decision or not- even with the existence of a well-defined problem (WEF, 2018b). Generally, BC can be applicable solution if a project meets four out of the following criteria; there are several parties sharing data, several parties can update the data, data has to be verified, existence of intermediaries add complexity, there is interaction among transactions and these interactions are time - sensitive (Akgiary, 2019 and PwC, 2018).

Although there is a current debate on the suitability and impact of BCT on accounting, it is believed that it will lead to a transformation in the accounting processes to catch up with the digitalization and the ever-

changing business world. It has the potential to solve some of the current corporate reporting challenges, and meet the wider characteristics desired for digital corporate reporting. Nevertheless, BC has to be subject to further monitoring, consideration and experimentation by all players in the corporate reporting ecosystem to determine when and where it is relevant and where it is not (ACCA, 2017 and FRC, 2018).

For the potentials of BCT to be fully realized, a wide adoption of this technology is required. In this respect, all players in the eco-system have to get ready to the disruption that this new technology will cause as it becomes increasingly mainstream. As BCT is evolving, the financial reporting stakeholders' community can work together to better understand its benefits, opportunities, challenges and risks and best practices. They should also sharpen their skills and be familiar with the new concepts and practices.

Preparers and users of corporate reporting should adapt to the changing business environment and gain more knowledge and understanding of BCT application and consider experimentation and cautious innovation as long as the benefits exceed its costs. *Business leaders* in large companies can take the initiative and lead the adoption of BCT by integrating it with their enterprise resource planning and accounting systems. As investment in BCT and its application increases, this will enable *researchers* to conduct studies based on practical applications. Moreover, *educators* will also need to include the application of BCT and other emerging technologies in the accounting curriculum to raise early awareness and knowledge of the opportunities of BCT.

Standard setters and regulators should not wait and see. Rather, they should monitor the continuous developments in BCT adoption, and work on increasing their knowledge and skills, while encouraging cautious innovation and experimentation through business incubators and sandboxes, as well as supporting multi-stakeholder dialogue in a non-supervisory environment. Also, *IT developers* should work on integrating BCT with other business systems and processes, while trying to overcome the risks and challenges

associated with its adoption. Engaging in dialogues with other players in the accounting ecosystem would be helpful so that they can develop valuable and efficient use cases for implementations.

Accounting professionals need to adapt to this new business paradigm and expand their knowledge and skills to meet their clients' needs, taking into consideration the new types of risks and challenges arising from the adoption of emerging technologies. They can also take a leading role in providing consultations on the implementation and auditing of BC systems, as well as taking various initiatives surrounding the new technologies to back their credibility. Embracing BCT by the Big Four may lead to a dramatic change in the accounting world (Founder's CPA, 2019).

7. Conclusion

Blockchain Technology (BCT) is one of the recent emerging technologies introduced by the fourth industrial revolution that is disrupting the global economy and influencing different industries, including accounting. It allows for peer- to- peer transactions through a secured immutable decentralized distributed database, eliminating the need for intermediaries or central authorities.

The objective of this study was to shed light on BCT and analyze its opportunities and challenges as well as its implications for accounting both on the national and international level. In doing so, the researcher conducted an in-depth theoretical analysis for BCT from an accounting perspective, and proposed a framework for BC implementation in the accounting field, viewing BC as an integrated element in the accounting ecosystem that includes different players who can act as nodes in the BC network. This theoretical analysis was supported by an online survey to explore the potential and implications of BCA in Egypt.

The results of the previous literature as well as the questionnaire showed that BCT is seen as a promising tool to the accounting profession, taking the profession from the double-entry bookkeeping system that has been used in

accounting for decades to the triple-entry reporting system based on the BC and cryptography and creating an environment for continuous audit based on real time data. However, although BCT offers a lot of benefits and potentials to the accounting profession and can lead to a more efficient corporate reporting process, it also comes with some challenges, threats, and risks.

Using BCT in financial accounting carries benefits such as increased transparency, the ability to trace transactions, timely processing, and prevention of tampering. In addition, Smart contracts can enable for the automatic generation of financial reports, resulting in reduced costs while enhancing timeliness, reliability and comparability of data. Moreover, it is also capable of reducing disclosure errors and earning management, thus enabling financial statements to truly depict the company's financial status and operational results.

Although BCT has attracted the attention of different players in the accounting system, including academics, professionals, standard setters and regulators, at this stage of early adoption, no conclusive evidence can be realized due to the lack of adequate research, and it is still not possible to fully realize the implication of this new technology on accounting and auditing. It is believed that it is not until its wide adoption by different companies that its true potential will be recognized. This adoption is expected to be in the form of an evolution not a revolution, especially that there are still many barriers to its widespread adoption, including awareness, confidence and regulation.

As the application of this technology becomes widespread, its implications will materialize, drawing the attention of standard setters and urging regulators to interfere and bridge the gap between the academics and practitioners. However, it should be clear that the adoption of BCT is not the remedy for all problems. BCT is good for specific problems, and where the benefits expected from its adoption outweigh the cost of its implementation.

For BCT adoption to gain momentum, a multi-disciplinary collaboration is recommended. A consortium composed of all the concerned parties with corporate reporting as well as the technology community is suggested. The

professional bodies, standard setters, regulatory bodies, and the leading accounting firms need to monitor the developments. The full potential advantages of BC to financial reporting can only be achieved if individuals who possess knowledge and accountability of financial reporting, internal controls, and auditing participate actively in discussions regarding BC and collaborate to introduce best practices. Researchers can also conduct studies on firms that have migrated their accounting records from the traditional to a BC- based system.

The limitation of the study lies in the novelty of this area of research as the adoption of BCT in accounting and auditing practices is still in its early stage, so only a theoretical approach has been followed to explore the opportunities, challenges and implications of BCT on accounting on the international perspective. This was also supported by an exploratory study using a questionnaire addressed to the Egyptian academics and professionals.

More applied research is needed to gain a better understanding of BC and its potential, as well as exploring the best practices and use cases with applicability to accounting and auditing. Future research may also include investigating the impact of BCT in areas other than auditing and accounting information system, such as corporate governance, sustainability reporting, cyber-security, as well as in a multi-disciplinary and trans-disciplinary context.

Future research can also analyze opinions of accounting professionals and provide critical analysis of actual implementation of BC solutions. Researchers can conduct field studies to investigate how auditors utilize BC auditing tools, follow accountants to comprehend their implementation and utilization of BC in various business applications, to identify potential areas where BC can be leveraged effectively by accountants and auditors.

In general, there is a need for more theoretical and applied studies dealing with the impact of the emerging technologies on accounting and auditing, as well as developing proposals for modern accounting models that combine traditional techniques and emerging modern ones. Also, developing clear

theoretical and practical frameworks for real-time accounting and auditing and financial analysis of big data are needed. This can be enriched through interdisciplinary academic research to determine the technological issues that affect BC adoption. Also, the collaboration between academics and practitioners can enable for assessing the use cases that practitioners are facing and encountering in their work. They can also work together on translating research into actual applications of BCT in accounting setting, as well as on issuing drafts of accounting and auditing standards that can direct accountants and auditors later to catch up with the most recent developments in IT environment.

Although the disruptive potential of BCT for the accounting and auditing professions is widely acknowledged, it is yet unknown how this transition will take place, what difficulties and possibilities will arise, and how it will affect the accounting profession.

The business world is changing, and all participants in the accounting eco-system must be ready for this change. They must be prepared and up to date with this technology for this shift to take the form of evolution rather than a revolution. Accountants and auditors should become more knowledgeable about and aware of BCT, particularly when used in conjunction with other cutting-edge technologies. In order to make the transition advantageous for everyone involved, all parties including academics, professionals, technology suppliers, standard-setters, and regulators must cooperate and work together to monitor, develop, standardize, and maximize the adoption of BCT.

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