



A proposed Framework for Integrating XBRL and Blockchain to Improve Financial Reporting Transparency and Integrity: XBRL Chain

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*Scientific Journal for Financial and Commercial Studies and
Researches (SJFCSR)
Faculty of Commerce – Damietta University
Vol.3, No.1, Part 1., January 2022*

APA Citation:

Serag, A., A. M. (2022). A proposed Framework for Integrating XBRL and Blockchain to Improve Financial Reporting Transparency and Integrity: XBRL Chain, Scientific Journal for Financial and Commercial Studies and Research, Faculty of Commerce, Damietta University, 3(1)1, pp. 497-545.

Website: <https://cfdj.journals.ekb.eg/>

A proposed Framework for Integrating XBRL and Blockchain to Improve Financial Reporting Transparency and Integrity: XBRL Chain

Dr. Asmaa Abd Elmonem Mohamed Serag

Abstract

The research aims to use the blockchain technology to ensure the distribution of XBRL content to a decentralized peer- to-peer network while maintaining the authority of the government toward the whole data. The topic of combination XBRL and blockchain is scarcely discussed in academic journal due to the very early stage of technology development. This paper explains how to build a distributed ledger platform prototype that designed to improve financial reports transparency and integrity by using blockchain technology in line with XBRL to form XBRL chain. XBRL chain helps in developing smart contracts that more business rules encoded in software, why are as good as the person or team devising the rules and the developer turning those rules into code. These smart contracts with newest encoded accounting rules could effectively control the recording of accounting activities. Therefore, these contracts would provide automatic assurance on processes, such as posting, classification and cutoff.

The proposed framework of XBRL chain makes the quality of information in the financial reporting more interoperability and comparability. This framework should subject to six situational conditions are: multi party, trusted authority, decentralization, smart contract, data confusability, and type of blockchain. This paper contributes to the literature by expending upon emerging concerns and providing opportunities for future research.

Key words: XBRL, Blockchain, XBRL chain, Notarization, Smart Contract, Financial Reporting Transparency, Blockchain p2p Network.

1. Introduction

Blockchain is one of the most important and promising technologies, that may have the potential for significant affect on the accounting profession. Blockchain technology and its applications have become a major catalyst of new ideas and solutions for accounting and auditing problems, financial reporting is one of the hot topic in accounting and publicly shared databases that have been discussed since 1970s (Pastena, 1979). In the last years a technological revolution also occurred fueled by the under spread diffusion of the internet. With regard to financial reporting, this trend also generated to develop the Extensible Business Reporting Language (XBRL) that many accounting experts expect to revolutionize financial reporting since it allows corporate financial information to be aggregated, transmitted and analyzed quicker and more accurately.

However, in these days, business ecosystems have some demands like information sharing and data communication in order to improve efficiency of financial reporting. There is a tradeoff relationship between transparency and privacy; the more information is shared, the more transparent the business will be, and the more potential that business secrets and separation might be involved. The tradeoff relation between information sharing transparency, data security, and data confidentiality is one of the main concentration points of today's business cooperation versus (Wang and Kogan, 2017).

XBRL is a technology that use to solve these problems in the trade-off relationship because it is consists of specific hierarchical dictionaries and it is an open international standard for digital business reporting for exchange of business reporting information within and across organizations. Generally, XBRL consists of two different specifications: XBRL financial reporting (FR) and XBRL Global Ledger (GL). The former is used to support the preparation of external financial reporting, while the latter is associated with accounting processes (Perdana, et .al ,2015; Awad, 2018).

Sometimes, it was said that XBRL is an old technology and it should be replaced with new technologies like blockchain or Artificial Intelligence (AI) However, can a technology replace a standard?

Blockchain and AI are both useful, impressive new technologies that will need data standards to work together effectively, but as they have completely different uses and purposes. From the XBRL standards, couldn't be used in place of data standards blockchain needs data standards, while are both used to communicate, blockchain uses data standards to record classify, and exchange information. Universal, machine readable standards are especially essential and important for automating process, as for example smart Contract AI has been posited as a replacement for XBRL as in theory, it could be possible for AI tools to be read and analyses financial statements that are not in machine readable format. However, AI is based on machine learning. For machine learning to develop, an AI system needs large quantities of machine leaning readable data to facilitate the development of (AI , an open data ecosystem and consistent for structuring and Labelling the data that are essential. As result, data standards aren't technologies they are, however essential for new technologies to develop and improve. (beerbaum, 2018).

That is why blockchain and AI cannot replace XBRL standard, however it can integrate with XBRL standard to facilitate machine readable, Consistent, and ambiguous data is critical for smoothing blockchain application. When Blockchain and XBRL are combined that may represent "a Centauromachy" (Beerbaum, 2020) the integration between blockchain and XBRL, public domain information such as corporate standing can be protected from illegal changes, maintaining the integrity and availability of such information on line (Abd. Whahab: 2019). The problem is how to ensure the distribution of XBRL Content to decent realized peer to peer network, while keeping the security of XBRL content and the whole data in financial reports (Abd Wahab: 2019), so, this research aims to develop a proposed framework for the integration between XBRL and blockchain technology that can improve the integrity and transparency of financial reporting.

2. Research Problem

Depend on a literature study by Berrbaumf (2018) the topic that combines XBRL and Blockchain is rarely discussed in academic journal due to that the very early stage of technology development, most of the authors suggested to use blockchain accounting as a business case,

blockchain represents an alternative to ownership ledgers based on double entry (Yermach, 2017, Deloitte 2018; Anderson, 2016; Beerbaum, 2020) blockchain could make accounting information more trust worthy and more available, as firms could keep their financial records in blockchain (Berbaum, 2020). Building on Risius and Spohrere (2017) calls for blockchain research to be more broadly based four research settings are identified in which it is plausible to argue that accounting knowledge is relevant and important to the design of features of a decent realized ledger system. **First:** choices over internal nodal transparency. **Second:** achieving cost effective means of regulatory compliance. **Third:** designing effective means of disaggregating asset registers and designing smart contracts. **Fourth:** insuring transactions can be effectively recorded tracked and analyzed so forensic provenance analysis can be conducted effectively (Risus and Spohrer, 2017, p.390).

However, implementation and application of blockchain separately has some challenges to be applicable in financial sector that are showed by (Oh and Shong, 2017). They are:

- Peer-to-peer Concept (p2p)-inability to define - a single responsibility party due to collaborative ownership of the information.
- Stability -Capacity of data may be limited to compare with actual financial reports capacity requirements.
- Transparency - privacy and security may be decreased by the pseudo - anonymity as all parties can trace all the transactions.
- System stability since data is not one repository, the control over computing capacity and resources could become - an issue (Abd.Wahab, 2019).

In addition to these challenges, that face the application of blockchain in blockchain all nodes have online local copy of the ledger. Thus, when someone notarizes a report such notarization is simultaneously updated in all nodes. As result, there is a need to Convergence between blockchain and other technology to overcome the weakness of it. Some academics suggest the complementary between Blockchain and XBRL like (Boixo, et al, 209; Berrbaum, 2019), (Abd whab, 2019; Berrbaum, 2020).

The convergence of the two-technology due to few aspects ;(1) non reliance to single authoritative party for verification, but via p2p interlocking System (Deloitte And Touche, 2016) (2) speed for processing, due to a large number of p2p network processing resources with most of the processes are automated (Berrbaum, 2018).

Beat the disadvantages of blockchain stability, transparency, information security and data integrity and stability. So as to, this research aims to explore the relevance of integrating XBRL and blockchain to improve financial reporting transparency and integrity. The future of integration between blockchain and XBRL will be revolutionist in the accounting industry as the topic of complementary is still new topic as most of the researchers are depending on searching this topic separately. Also, most academic literature is still in its early stage to issue articles about the topic. As the topic is very much driven by new technology of blockchain that will need more time until more literature will be issued.

The structure of this research is organized as follows: first: - Literature review about integration between XBRL and blockchain, Second: Theoretical framework. Third: Research methodology, fourth: The application of XBRL Chain in Case. Fifth: conclusion and - future researches.

3. Literature about Integration between Blockchain and XBRL.

According to the academic and nonacademic literature relate to the integration between XBRL and blockchain, there is few or rare researches that combined the two subjects. Most of sources are available in form of conference papers or working papers and few papers about the subject. As the topic is still new, the subject is much discussed, however it will take much time that literature become available in peer reviewed journals. The literature about XBRL and blockChain can be summarized in some dominant topics as the following:

- Continuous auditing and using the integration between the two subjects in verification and doing the procedures (Dai, 2017; Chan, et. al, 2018; Dai and Vasarhelyi 2017).

- Real time accounting and financial reporting with XBRL and blockchain. This integration can improve the Credit risk modeling (Baustrom, 2016; Trigo, et al., 2014).
- Acceleration of time with XBRL blockchain (Colgren, 2018; Monteria, 2016).
- How to build a distributed ledger platform prototype from the ground up, specifically designed to manage financial reports, in the line of other proposals in the financial area. As Corda for financial agreements (Brown, 2016 ; Boixo, et.al, 2019).
- Design and implementation of a prototype to validate and store financial statements using Ethereum blockchain (D'atri, et al, 2019)
- Exploring the suitability of integrating XBRL and blockchain technology within Malaysian Context to improve corporate transparency Integrity and availability (Abd.Wahab, 2010). Summarizing the existing literature that relates to combine XBRL and blockchain the centaurography.

After reviewing the literature, it is pointed that the academic literature is still in its early stage to issue articles about the topic. As the topic is very much widen by the new technology of block chain it will take much time until more literate -will be made public.

4. Theoretical Framework.

4/1. The Benefits of integration between XBRL and Blockchain.

Filings based on reviewing the literature, the topic that integrates the blockchain and XBRL is rarely discussed in academic researches as result of the very early stage of Block chain development. There are some applications of blockchain to XBRL filings as in the following aspects and depicts in Figure (1):

- 1) XBRL and blockchain can form a kind of “products symbioses” as this is known from biology. Blockchain will become more efficient, if XBRL provides high- quality structured data, XBRL has the advantage as it represent the de-factor standard or the electronic exchange of financial and non-financial information and ensures that along the financial supply chain stakeholders machine to machines

can communicate efficiently without any data breaks. The expectation by the market are very high given the vast investments in blockchain infrastructure projects.

- 2) Speed is a next domain; in which block chain and XBRL have its real advantages.

Accounting processes can vastly automated while Control and audit costs will decrease due to the built in- validation, XBRL Combined within blockchain has the potential to enable real time reporting and real time accounting, as stakeholders can directly access to blockchain accounting information (Beerbaum,2020).

- 3) Security will be very high as non-reliance to single automotive party for verification, but via p2p interlocking System (Deloitte, et.al, 2016).

- 4) speed for processing, due to a large number of p2p network processing resources with most of the processes are automated (Beerbaum, 2018).

- 5) Scalability

Scalability means the ability to handle increase workload without adding resource to a system. Another meaning is the ability to handle increased workload by repeatedly applying a cost effective strategy for extending a systems capacity. The integration between XBRL and Blockchain can help to achieve system scalability by the trade of between functionality and scalability to recognize that it may be possible to handle additional users or demands in the system.

If the system provides less service overall. Designing a system to provide differing level of functionality may be one way of achieving a scalable system.

- 6) Transparency

The combination of XBRL and Blockchain can help in increasing the system transparency that means a system security architecture of the XBRL chain will be better as it is XBRL secured by blockchain has some other inherent characteristics that provide additional means of security.

Blockchain is a forecast to be future of financial and cybersecurity (Nabben, 2020).

7) Data Integrity and availability

The integration between XBRL and blockchain can increase confidentiality, integrity and availability. The CIA triad of confidentiality, integrity, and a availability is considered the core underpinning of information security. Every security control and every security vulnerability can view in light of one or more of these key concepts.

XBRL Chain improve the integrity and availability. The first measures protect information from unauthorized alteration. These measures provide assurance in the accuracy and completeness of data. The second measures protect timely and uninterrupted access to the system. XBRL chain system to be useful, it must be availability to authorized users.

8) System stability:

XBRL chain is characterized by stability as the system stability is the finite output produced by a finite input of the system.

If the system output is infinite even when a finite input applied to a system then this system is called “unstable system” that is, stable system has bounded output when bounded input is applied to a system.

- 9) The integration will help the characteristics of blockchain to be involved into XBRL implementation without the concern of reducing the control of instances information. The basic instances will still be stored in the private storage databases. The taxonomies will be then shared within p2p network, developing interlocking mechanism directly to the taxonomies, and indirectly to the instances. Thus, by extending the taxonomies into the blockchain network p2p, the firms will be able to participate into the blockchain p2p network which will allow better integration:

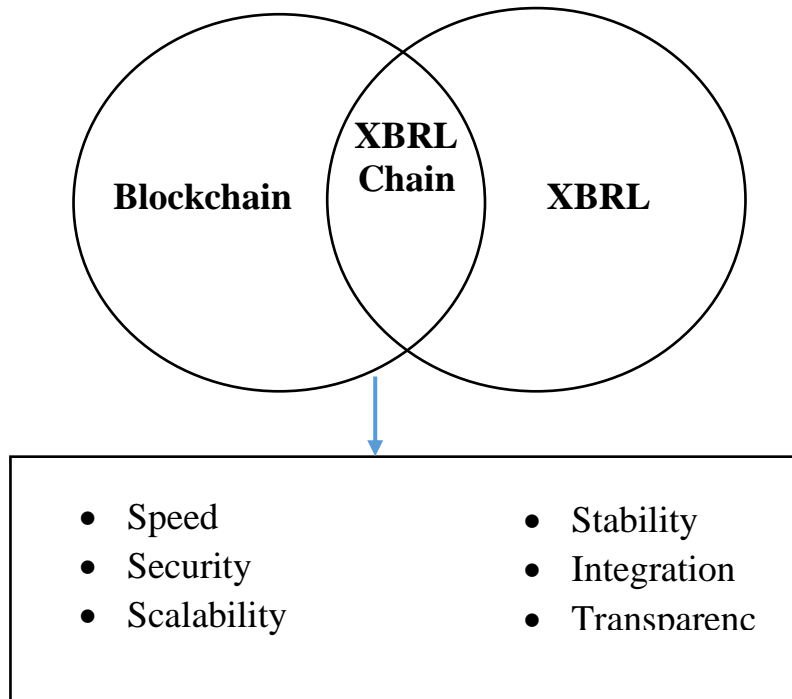


Figure (1): The Integration Between XBRL

(Source: The Researcher)

The convergence towards the integrated use of new digital technologies is now an inescapable process. There are too many advantages and opportunities arising from the integrated use of all these advanced tools. On the other hand, accounting will face many challenges like lack of trust, security, and transparency positive answers to challenges are often found through the combination of different technologies (for instance Artificial Intelligence, Accounting information system, blockchain).

In some cases, one single digital technology is sufficient to solve problems that afflicted the accounting system for example, the blockchain solves the problem of reliability and trust.

Figure (2) depicts the integration between innovative tools to digital future of accounting knowledge management.

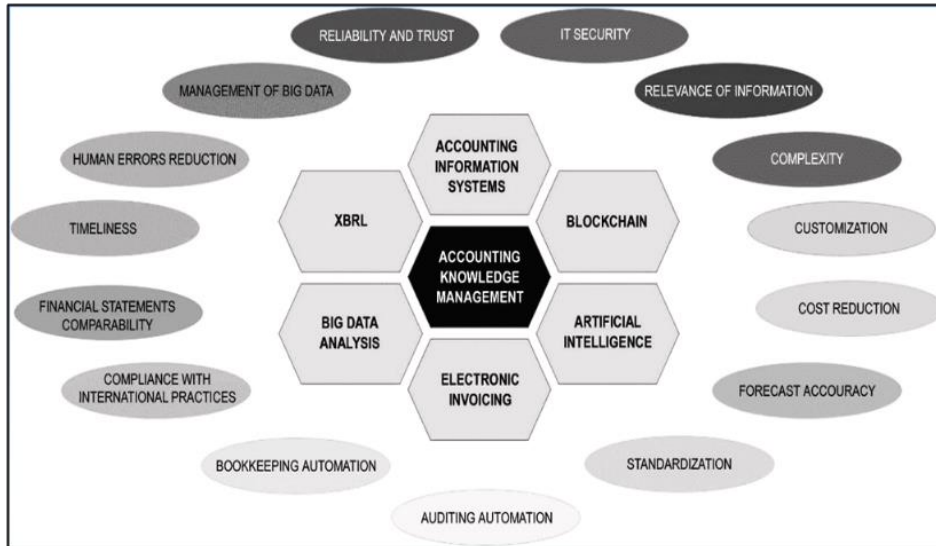


Figure 2. Digital Future of Accounting Knowledge Management

Source (Mosteanu and Faccia 2020, P.164)

The blockchain can be divided into three Categories three types according to the level of control (Oh and Shong, 2017):

- 1) Public Blockchain: fully open access with almost no governance ownership
- 2) Consortium Blockchain: governed by a group of trusted parties; and
- 3) Private Block: fully governed by an authority to serve a specific purpose.

This classification is based on the level of Control over the blockchain network in which, to serve the requirement of public Authority and governance body. The issue of governance had also being raised by European Financial practitioner as suggested by (Colgren, 2018), leading to the formation of European Financial Transparency Gateway (EFTG), experimenting blockchain with the whole financial life cycle. This trend of Convergence between blockchain and XBRL

moves by XBRL counterparts in the USA and Europe the Convergence seems very beneficial and it will be more inevitable, however how to ensure the distribution of XBRL content to a decentralized peer-to peer network while maintaining the authority of the government towards the whole data.

4/2 The Integration Phases of XBRL and Blockchain.

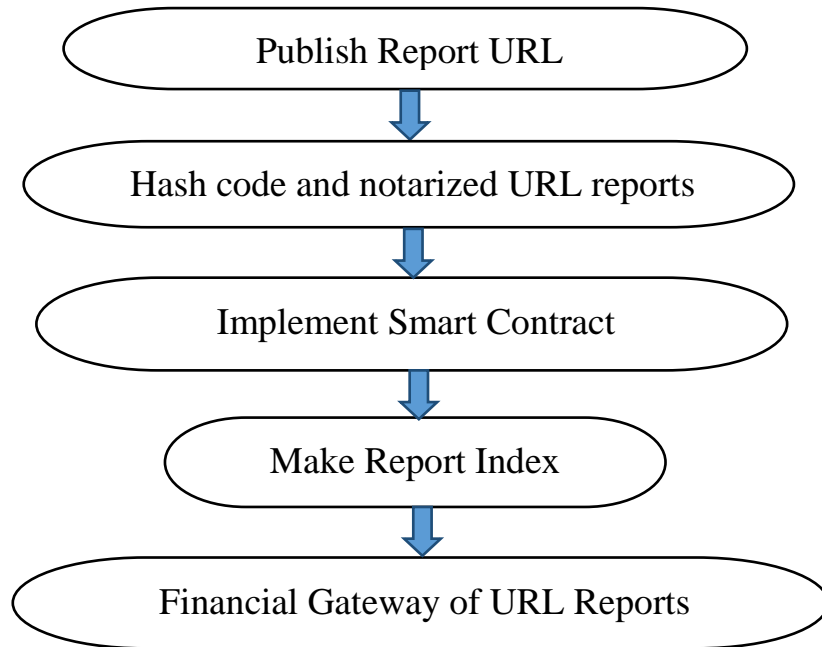
- **The first phases** relate to taxonomies of XBRL as XBRL consists of two main information components: XBRL instances and taxonomies. The XBRL instances are the records that controlled and submitted the authority of the company via manual logements on the other hand, the taxonomies, that are not the statutory information which are described by companies. This means that taxonomies are the components of information that can be integrated blockchain technology. Thus, the integration of XBRL and blockchain can by extending the taxonomies into the blockchain network. This first phase will enable to incorporate the characteristics of blockchain of technology into XBRL implementation without the concern of relieving the control of instances information as the basic instances will be stored in private records, and the taxonomies will be then shared within P2P network. This phase is considered as Transitional stage where the companies will able to incorporate into the blockchain P2P network that will improve integration with the industry (Abdwhab,2019).
- **The second phase** of integration is that blockchain is consortium or private that means the control is governed by a group of trusted parties or by a specific party. So that this will be eventual integration which will allow faster and secured integration.
- **The third phase** is to use Inline XBRL and blockchain to build smart contracts. (Dennis, 2018) demonstrated the use of Inline XBRL and blockchain to automate and enhance insurance Contract management with “smart contracts” embedded into the system. Current reporting System require inefficient and redundant exchanges of data between the data systems of multiple participants for examples, this creates room for error and inconsistencies. Reported replaces this with a distributed ledger, which uses blockchain technology to allow each participant to access and store

data simultaneously, pushing any updates to participate in near – real time" a less cumbersome, more accurate and transparent system. By combining distributed ledger with Inline XBRL machine readable "smart data", data can be automatically validated and verified with invalid data rejected From database, further reducing errors, by using XBRL to layer smart data over human readable contracts, and a distributed ledger to ensure all parties have access to the same data at the same time, Reports can create accurate, trusted "smart Contracts".

The main benefits created by these innovative tools include reducing the human error, low risk of fraud, system automation, big data analysis, huge cost saving (by increasing efficiency and decreasing in errors), increased reliability in financial reports and reduced workflow (Mosteanu and Faccia, 2020). This integration between blockchain and XBRL represents combination of financial information with tech capabilities will accelerate digital transformation of finance and accounting, and may create a more safety business.

4/3 XBRL chain Demo

The outcome of integration between XBRL and blockchain is XBRL chain demo. It is the development of XBRL when it is secured by blockchain. In XBRL chain demo each URL report each report is stored in blockchain and each report has code and identify the person who has notarized report. This strategy of linking a URL with the hash code of the object addressed by such URL is in the roots of the sub resource integrity. A characteristic of blockchain is that all the nodes have an online local copy of the ledger. Thus, when someone notarizes a report, such notarization is simultaneously updated on all nodes. A smart Contract can be implemented, which triggers an event when a new notarization is generated. A financial Gateway can read the report from the publication websites by using the notarized URL and including its attributes in sport index. The steps of XBRL Chain demo can be summarized in the following Figure (3):



(Figure 3: XBRL Chain Framework.

(Source: The Researcher based on Abdwhab, 2019)

5. Research Methodology.

This paper is an exploratory research that aims to explore the possibility of integration of XBRL and blockchain using the normative approach. The Case study will adopt the suitability Evaluation Framework. This Framework is based on the principles and basics of (Lo, et. al, 2018) which was built to evaluate suitability of applying only blockchain on Australian Government Systems. In the proposed Framework of suitability of applying XBRL and blockchain. The proposed framework should subject to six situational conditions. If these situational conditions are met together, the proposed Framework will be suitable and applicable, the six situational conditions are suggested by LO, et al., 2018 :

- (1) Multi party is required.
- (2) Trusted authority is required.
- (3) Trusted authority should be decentralized and the operations are centralized in the blockchain.
- (4) Linking the transactions with blockchain and implement smart contract to prepare report index.
- (5) Data confidentiality immutability can be done.
- (6) The type of blockchain is private or Consortium to permit for parties to store large amount of data and high Velocity data and there is control over all nodes.

The first Condition means that there are multiple parties are involved in the scenario the operations or transactions between parties are normally governed by intermediaries that are acting within the current things.

The second condition is whether a trusted authority is required in the scenario. Trusted authority relates to the entity that is authorized to execute a certain operation or alter a policy or configuration of operation, Examples of the trusted authorities would be a banker and government.

Also, **the third Condition** whether the operations on the application is centralized or not. In blockchain-based systems that use

smart contracts the changes will be easier. In the smart contracts, there is codes that regulates the interactions between mutually untrusting parties that will consist a report index. Thus, the **five Conditions** will be achieved and that will guarantee data immutability to happen. The framework of evaluation suitability of integration between XBRL and blockchain can be showed in the following figure (4):

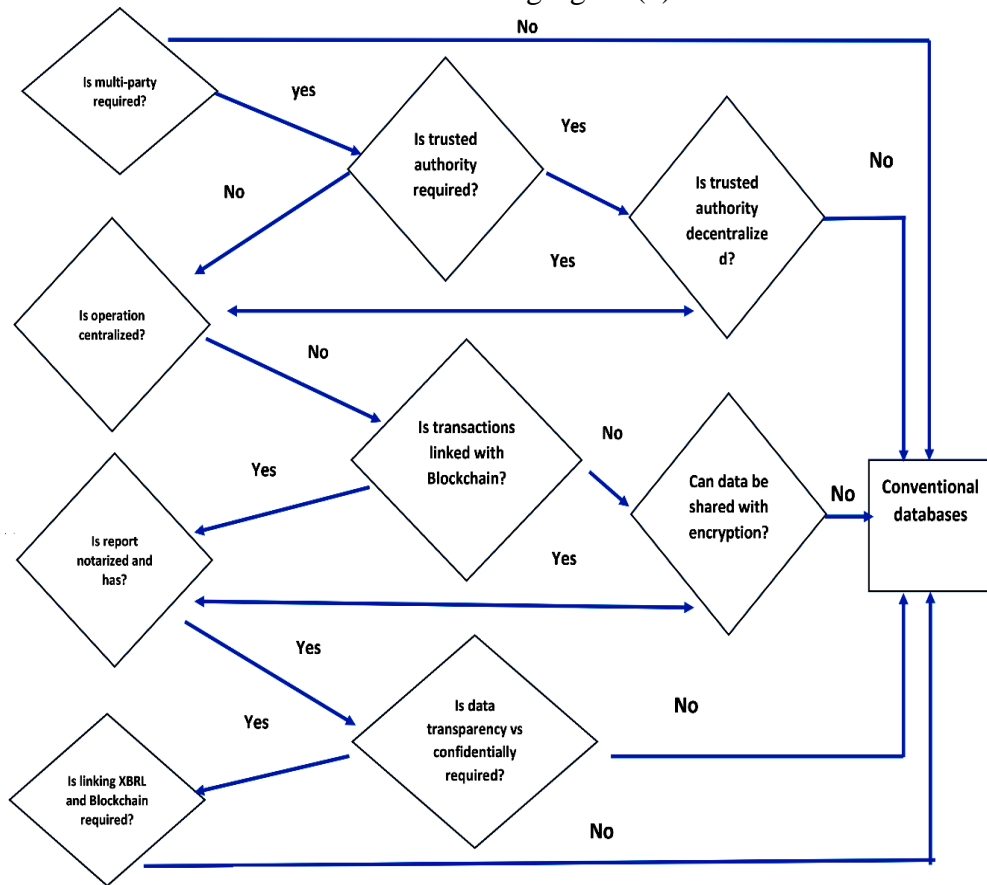


Figure (4): Situational conditions of integration between XBRL and Blockchain

(Source: LO, et al., 2018)

After the case implements the situational conditions, it should follow these procedures:

- (1) Publish a report on its own website's URL.
- (2) Submit the report to notarization and hash function.
- (3) Publish a report on the websites using the Officially Appointed Mechanisms (OAM).
- (4) Provide Really Simple Syndication feeds (RSS) that helps to improve financial disclosures test as RSS creates legal insider trading Windows, depending on how the investor is notified about the existence of the released report.
- (5)) As block chain has distinguished feature, all the nodes are simultaneously fed with each new block for updating the local blockchain copy. Each block chain node can explore, in parallel, each new block that detects a new entry of Notarized report. Thus, in this step, Notarize the hash of the of all blockchain nodes simultaneously with report URL of publication (that are not actually published).
- (6) Submit the report to OAM.
- (7) Wait for OAM acknowledgment.
- (8) Publish the report on the URL.
- (9) It's worth noting that when OAM notarize again the hash of report, this is simply the same hash that has been notarized several times.

6. The application of XBRL chain in the Case.

XBRL chain is the application of blockchain to preserve integrity and improve transparency of financial reports that are prepared by XBRL stand. The case study tries to explain how to build a distributed ledger platform prototype from the beginning. The prototype is designed to manage financial reports and proposals in different financial areas. To implement XBRL chain:

First: - assume in the case that a document is upload and assigned a distinguished and secure code with a standard, hash algorithm and this code should be notarized by an authorized party in the blockchain

Ledger. Next, checking the validity of a document is done by recalculating the code and comparing it with the Ledger, also, retrieving the identification of the authorized party. It is important to note that several authorized parties (issuer, auditor, and supervisor) can indecently sign the same document. The identification of the issuer, the type of report the period... is already mandatorily included in the XBRL document, in accordance with the XBRL specification. The only requirement is that the XBRL instance document must be self-Containing.

The second step of the case explains How is a document Notarized

The authorized party requests the services of a not any webserver, which is authorized to write to the blockchains. The blockchain system must have a secure interface with a webserver, as well as a smart contract definition interacting with the ledger.

The third step of the case analyzes how documents are checked. Each check web server with reading access machine to blockchain that can retrieve and check each hash code generated by the respective authorized parties acting as notaries for such hash code. The above three steps are essential to develop XBRL chain or XBRL secured by Blockchain.

*** Conclusion:**

Blockchain could be the next step in digital accounting and may be a Game Changer due to its disruptive characteristics and advantages as validation of postings, verification of financial and non-financial information, and acceleration of time. The basic distinguished aspect in the application of Blockchain technology is verification without having the obligation to depend on a trusted third party.

Companies can have the possibility with blockchain to write their transaction directly into a joint roaster. XBRL enables structured data, which is a prerequisite for machine readable blockchain. With the XBRL and blockchain can form a kind of "product symbioses" as this is Known from biology. Blockchain will become more efficient, if XBRL provides

high quality of data structured as it has the advantage of de-factor standard for the electronic exchange of financial and non-financial information. In addition to that XBRL and blockchain integration has the advantage of real-time and real-time accounting, as stakeholders can directly access to blockchain accounting information by building XBRL Chain. The most important feature of XBRL chain is to notarize each report of financial reports that helps to develop smart Contracts. Thus, XBRL chain is XBRL secured by blockchain.

After identifying the integration areas between XBRL and blockchain, a descriptive study is done to evaluate the initial practicality of the integration. The situational Conditions of applying the integration is deduced and the steps of XBRL chain are identified. There are many chances to investigate the implications of the integration towards multiple industries as well as stakeholders.

**** Suggestions for Future Research:**

Several limitations of the current study could open an avenue for future research in XBRL and Block chain in the Egyptian environment:

- The proposed framework of integration between block chain and XBRL can be analyzed from Cost-Benefit Perspective.
- Decision problems in blockchain Governance and security.
- Transformation of supply chain to Digital supply chain using Blockchain technology.
- The application of smart contracts in insurance firms in Egypt
- Re-engineering a financial information relates to supply chain with XBRL chain.
- Determinations of Blockchain-based applications in different sectors in Egypt.
- Integrating Blockchain with ERP for transparent supply chains.
- Using blockchain technology to improve Supply Chain Traceability.
- Analyzing the implications of the integration from stakeholders views
- Combining usage of XBRL General ledger (XBRLGL) and (XBRLFR) for the purpose of internal and external reporting.

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المخلص:

يهدف هذا البحث إلى استخدام تقنية سلاسل الكتل Block chain في زيادة مستوى أمن المعلومات لمحتوى التقارير المالية المستندة إلى XBRL في إعدادها، ويعتبر اعتبارات الأمن والسلامة والحفاظ على التكامل وإتاحة معلومات التقارير المالية من أهم التحديات التي تواجه تطبيق XBRL في البيئة المصرية ولذلك يسعى البحث إلى بناء إطار مقترح لكيفية حوكمة والحفاظ على سرية وأمان وتكامل معلومات التقارير المالية المعدة وفقاً لمتطلبات XBRL باستخدام تكنولوجيا سلاسل الكتل، ويعد موضوع التكامل بين سلاسل الكتل Block chain ولغة التقارير المالية XBRL من أحدث الموضوعات المحاسبية التي تناولتها الدوريات المتقدمة في نظم المعلومات وستزداد أهمية هذا الموضوع نتيجة للتطور التكنولوجي في الفترة الأخيرة.

قد يساعد الدمج بين لغة التقارير المالية XBRL وتكنولوجيا سلاسل الكتل Block chain على ضمان توزيع محتويات التقارير المالية المعدة وفقاً لـ XBRL على شبكة لا مركزية تحكمها قواعد وإجراءات أمن وسلامة المعلومات المتبعة في تكنولوجيا سلاسل الكتل، بالإضافة إلى ذلك ربما تنشأ سلسلة لـ XBRL تساعد في خلق عقود/اتفاقيات ذكية Smart Contract تلك العقود تتبع قواعد توكيد وتسجيل حديثة للعمليات المحاسبية، ويوفر ذلك ضماناً لسلامة عمليات التسجيل، التوبيخ والترحيل مما يجعل المعلومات التي توفرها سلسلة XBRL معلومات أكثر ملائمة ومنفعة للمستخدمين، يخضع ذلك الإطار المقترح لستة ظروف موقفية: تعدد الأطراف المشاركة، موثوقية السلطة، اللامركزية، بناء اتفاقيات ذكية، منع النشوء في البيانات ونوع سلسلة الكتل.

الكلمات المفتاحية: العقود الذكية، سلسلة XBRL، شفافية التقارير المالية وشبكة أعمال سلاسل الكتل.