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Block chain Accounting in A Triple Entry System – Its Implications on the Firm

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ABSTRACT

Double-entry accounting is one of the most valuable resources within a company for both gathering information and retaining control over its operations. The accounting method and the annually published financial statements is an invaluable tool not only for shareholders and management but also governments and tax authorities. However, in its current state, it is clear that the double-entry system is limited and can be worked around. As the accounting of a company is subject to opinions and individual values, it is far from a reality and can be largely manipulated, as has been the main focus of many high-profile company scandals. The best attempts to making accounting reflect reality and aligning assumptions between companies have been regulations and international standards such as IFRS and FASB. Despite regulations and established practices, there are still limitations in accounting that allow for fraud to occur, such as the possibility of fabricated transactions and verifications. To confirm the integrity of a firm's accounting, shareholders and governments require auditing on a regular basis. This process of validations and control does, however, amount to many costs and inefficiencies for the company and does not provide any real value to its operations. Not only is it time-consuming and subject to errors, but it is also expensive. All this, only so that stakeholders can ensure that the reporting was done correctly.

With the emergence of digital and increasingly automated solutions for accounting, interesting developments have been emerging for transforming the entire accounting process. One technology which is particularly interesting for technology enthusiasts is accounting on blockchain technology, as it could offer more secure and smarter forms of accounting. Blockchain technology is a revolutionary computer protocol used for recording and storing information on multiple computers. It is only a new form of database. While traditional databases have been centralized, relying on one party to handle all data, blockchains are distributed and rely on multiple nodes. By building a network of computers that all store the exact same ledger of information, it is easy to see when there is a manipulation. If all computers agree and store the same data, however, one party has changed their information, it

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is easy to spot the anomaly. This makes both tampering and hacking difficult, as they would require changes on many computers, not just one.

KEY WORDS

Blockchain Accounting, Triple-Entry Accounting, Real-Time Accounting, Automated Audit

INTRODUCTION

Triple entry accounting is an enhancement to the traditional double entry system in which all accounting entries involving outside parties are cryptographically sealed by a third entry. These include purchases of inventory and supplies, sales, tax and utility payments and other expenses. Placed side by side, the bookkeeping entries of both parties to a given transaction are congruent. A seller books a debit to account for cash received, while a buyer books a credit for cash spent in the same transaction, but in separate sets of accounting records. This is where the blockchain comes in rather than these entries occurring separately in independent sets of books, they occur in the form of a transfer between wallet addresses in the same distributed, public ledger, creating an interlocking system of enduring accounting records. Since the entries are distributed and cryptographically sealed, falsifying them in a credible way or destroying them to conceal activity is practically impossible.

The companies using triple entry bookkeeping would derive two immediate benefits from adoption: First, since auditors could quickly and easily verify a large portion of the most important data behind the financial statements, the cost and time necessary to conduct an audit would decline considerably. Audits would still be necessary, but auditors could spend more time on higher risk areas such as internal control. Second, the integrity of a company's financial statements would be essentially unassailable. Revenue and expense transactions could not be falsified if they required the encrypted signature of the counterparty in order to be accepted as valid.

It isn't difficult think of ways to manipulate even a highly reliable system like the one described. Schemes like off balance sheet arrangements, improper valuations, disguised self-dealing, etc. would still be possible under a triple entry model, so new regulations would be necessary to mitigate some of the new sources of risk. These could be totally voluntary or only required for publicly listed companies, though companies of all sizes stand to benefit from better financials. For example, US Generally Accepted Accounting Principles could adopt the stance that, if it isn't on the blockchain then it does not exist / didn't happen and cannot be included in the financial statements. Rather than being created at random, financial wallet addresses could be assigned by a trusted third party such as the SEC or some yet to be

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created private organization in order to guard against abuse. It is true that new regulations would require firms to share some amount of proprietary information, but probably not more than they are currently required to disclose, just in a different form. The standard of privacy enjoyed by public firms in the United States is already quite low.

Triple entry is possible using existing Bitcoin infrastructure (with minor modifications) and highly desirable for both companies and outsiders. Its adoption would enhance the credibility of the financial statements of participants. Further, triple entry would empower smaller enterprises and create opportunities for growth by offering a very low cost way to prove economic activity to outside stakeholders, such as banks or angel investors. Triple entry accounting doesn't address every financial statement assertion or totally take risk off the table, but its adoption would contribute greatly to the safety and stability of securities markets

OBJECTIVES

The purpose of this study will be to continue previous research on blockchain accounting and to explore how the technology could alter industries and professions over time. It will attempt to answer and extend the questions proposed by various researchers by identifying where blockchain applications could create the greatest efficiencies, prevent fraud and reduce waste, and it will discuss how these changes could alter jobs and industries. To achieve these purposes, the study has been narrowed down to answer the following two research questions:

- In what areas could blockchain accounting be leveraged to create the greatest efficiencies, prevent fraud and reduce waste among the firm and its stakeholders?
- What effects could such innovations have on individual businesses, their key stakeholders, and the professionals within them?

RESEARCH METHODOLOGY

To evaluate the prospects of blockchain accounting, a deepened understanding of the blockchain and its current technological state is required. Because blockchain accounting is still in its infancy, a qualitative approach will be taken to make initial explorations on the topic. In order to fulfil the purpose of analysing the use of blockchain technology in accounting, the study will first conduct a literature review on topics relevant to blockchain and its relation to accounting, hence giving an overview of the possible intersection between the two. Once the two pillars of past and current developments have been examined, the potential effects can be analysed from the perspective of individual firms and their key stakeholders. To achieve this purpose, a stakeholder approach will be used to conduct the

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relevant analysis. In order to ensure the validity of this , critical arguments will be included throughout the text. Actors with a vested interest in blockchain technology have obvious reasons for being overly positive or subjective in their analysis and therefore risks affecting the conclusions drawn in this study. Hence, by actively including and considering criticism, a balanced perspective can be maintained and these risks mitigated.

LITERATURE REVIEW

Blockchain technology is still in its early stages, yet its development is extremely fast-paced. With a high level of complexity and many independent projects working simultaneously, it can be hard to keep up. As this increases the risk of errors and misinterpretations, it is of high importance that the study aggregates and reviews the current state of both academic and professional literature in the topic of blockchain technology, particularly within the subject of accounting. The study will first review the history of the blockchain and explain its basic function and application. While it is not the purpose of this study to explain the technicalities behind the blockchain, it is essential to first explain the basics of the technology to avoid misunderstandings and set the frame for the exploration of its current state. This will be done primarily by studying the original white paper of Bitcoin by Nakamoto (2009), and the more recent development of the Ethereum project through the Ethereum white paper (Buterin, 2014). While these sources do not suffice as academic literature, they are the primary sources and official blueprints of these projects, making them the most accurate explanations of the technologies. They will, however, be complemented by professional literature to explain the technical details of blockchain and to discuss them in terms of business opportunities.

Following this explanation, the thesis will explore the state of current literature in both blockchain and accounting. The purpose of this is both to gain an understanding of what effects blockchain technology may have had up until this point, but also as to explore the prospects of it. This should later serve as the foundation for a discussion of what effects blockchain accounting could have on an organization and its stakeholders.

THE HISTORY OF BLOCKCHAIN

The blockchain technology proposed by Nakamoto for Bitcoin was a revolutionary protocol that handles transaction history through a decentralized ledger and validates transactions through cryptography. The decentralization of the ledger means that each individual computer (node) holds some, or all, of the transaction history and that the network of all nodes together agrees on the correct transaction history. This agreement is found by identifying what the majority of nodes agree upon is the correct ledger. The incentive for validating and storing

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transactions, or "blocks", comes through fees paid and rewards given for computations, as explained in Nakamoto's white paper (2009).

The frameworks of the decentralized blockchain turn out to have many more use cases than only that of a currency. The Bitcoin blockchain stores information on a ledger in the form of transaction details, however, other types of information could be stored in the form of computer code. As Deloitte explains it, "Despite its apparent complexity, a blockchain is just another type of database for recording transactions – one that is copied to all of the computers in a participating network" (Deloitte, 2016).

In the design of different blockchains, there are differences between so-called private and public blockchains. As explained by Deloitte (Deloitte, 2016a), public blockchains such as Bitcoin are completely open and allow all parties to read and write, while private blockchains have user statuses in where selected parties can be assigned specific authorities. Although the original Bitcoin blockchain was designed to be public, there are important use cases that would only be possible on private blockchains, as many organizations obviously do not want to keep their data public (Deloitte, 2016).

TRIPLE-ENTRY ACCOUNTING ON THE BLOCKCHAIN

As the blockchain technology continues to develop and new use cases are being explored, accounting has been identified as one field that could greatly benefit from the distributed ledger and other features of the blockchain. The primary benefits discussed include decreased risk of fraud, automatization, huge cost savings and increased truthfulness in financial reports (Martindale, 2016). The exact implications of blockchain-based accounting are yet to be seen, however, as Deloitte stated, "at the end of the road, fully automated audits may be reality" (Deloitte, 2016).

Grigg - Triple Entry Accounting

Grigg's model (2005) proposed a system in which two parties transact, and the transaction is validated by a third-party. This third-party would then remove the need and limitation of the receipt. As Grigg points out, in the current system, "the receipt is the transaction" and is crucial for the double-entry (Grigg, 2015). An extension of the current system, with the introduction of a third-party, would create a validation of the transaction that is harder to dispute, making it much more secure than the two-party signature. This would, in effect, render the traditional receipt as a proof of transaction as obsolete. A transaction could be easily proved by the matching of the other party's receipt, and Grigg suggests that through modern cryptography, the digital, cryptographic signature "gives powerful evidentiary force

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to the receipt" (Grigg, 2015). Implications would be a reduction of fraudulent behaviour, as well as increased internal control. Grigg also suggests that not only does the transaction and its proof get integrated into the three-party system, but that the invoice goes through this process as well. This entire system would, of course, run on software and therefore enable a level of automation.

However, the triple-entry proposed by Grigg has a major flaw by requiring a trusted and neutral third-party. The difficulties posed by this, combined with risks such as cyber-attacks, make the system hardly seem secure or practical enough to implement. The concept might, however, be a perfect fit for the blockchain, as it offers an automated, secure and immutable solution. The distributed ledger could thus store verifications and provide a tamper-proof audit trail automatically and act as a third (digital) party verification. Through smart contracts, it could even follow accounting standards or pre-determined business rules.

Dai & Vasarhelyi - Toward Blockchain-Based Accounting

Triple-entry accounting on the blockchain would be based on the system proposed by Grigg, however, the third neutral party would be replaced with the blockchain. Dai and Vasarhelyi (2017) suggest that such a model would be based on a private, permissioned blockchain, as the company would retain control over their information and could thus exclude irrelevant parties. Such a system would also be faster and more efficient, as fewer nodes are needed to confirm a transaction. As described previously, blockchain entries require verifications, and in this case, they could be done by accountants, management and auditors.

The authors propose a system that would be built on top of the existing double-entry system, with a third blockchain layer embedded into it, and would record transactions both within the organization and with external parties. To represent current assets and liabilities more accurately, the system would embed a layer of tokens that could represent accounting entries. These tokens could be considered a representation of a physical object such as inventory, or hypothetical objects such as obligations. The bookkeeping on the blockchain layer would be done by connecting each blockchain account to its corresponding double-entry account in the ERP system.

Kokina, Mancha & Pachamanova - Blockchain: Emergent Industry Adoption and Implications for Accounting

An article by Kokina, Mancha and Pachamanova from Babson College (2017) on blockchain adoption and implications for accounting summarizes the latest developments in blockchain technology and examines industry adoption. In their paper, the authors discuss projects

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initiated by companies such as IBM, JPMorgan, the Linux Foundation and Philips. The paper finally studies blockchain initiatives by the big four auditing firms such as Deloitte Rubix, EY Ops Chain and PwC DeNovo and the implications accounting on the blockchain could have on assurance. They discuss cost savings and mitigation of human error and fraud through use of blockchain accounting, eliminating "the need to enter and reconcile the information in multiple databases".

Byström - Blockchains, Real-Time Accounting and the Future of Credit Risk Modeling

In his working paper "Blockchains, Real-Time Accounting and the Future of Credit Risk Modeling" (2016), Hans Byström explains how Real-Time Accounting on the blockchain could fundamentally transform risk assessments of companies. Through case studies and hypothetical scenarios, the author proves significant improvements in credit risk models with real-time information, compared to financial statements "prepared at regular intervals", arguing that not even all information would have to be published instantaneously for this effect to appear (Byström, 2016). With such an availability of information from Real-Time Accounting, Byström provides hypothetical scenario in where "the entire area of bankruptcy prediction could change" and financial instruments could be tailored to the likelihood of default using smart contracts (Byström, 2016). As external parties gain new insights into all of a firm's transactions, Byström argues a scenario with "managers, creditors, investors and regulators playing by entirely new rules" and "issues such as reflexivity could affect a firm's path towards bankruptcy to a larger extent than today" (Byström, 2016).

Deloitte – Blockchain: A Game Changer in Accounting, Audit Processes and its Potential in Taxes

Deloitte has published a articles on blockchain technology and its implications for businesses, discussing major advances in banking, insurance, energy trading and many more (Deloitte, 2016a). Though less prominent, they have presented some initial speculations on the future of Blockchains in the accounting field (Deloitte, 2016b). Beyond the obvious and already discussed cost benefits of automation, Deloitte suggests blockchain accounting offers faster and more efficient access to information. Auditors, banks and other third parties could access verifications and bank statements directly on the blockchain, removing the need for requests and confirmations. In a separate article, Deloitte published a 2017 report on "Blockchain technology and its implications in taxes". While the report does not focus on blockchain accounting, it suggests some of the areas in which blockchain technology may have major implications for tax authorities, particularly in fraud prevention but also in automation.

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Coyne & McMickle - Can Blockchains Serve an Accounting Purpose

In their paper, the concept of accounting on the blockchain is declared infeasible due to the trust problems imposed by the blockchain technology and the distributed network. The authors argue this based on the Byzantine Generals Problem, a thought experiment illustrating "how corrupt communication threatens successful coordination across a decentralized network" (Coyne & McMickle, 2017). They argue that the use of a public blockchain would be improbable as firms likely would not want to share their information publicly and that private blockchains would fall apart due to trust issues between the nodes on such a blockchain. These trust issues include the limited number of nodes, required trust between nodes and risks of corruption. As stated previously, private or permissioned blockchain are limited in their security compared to public blockchains. Although providing a solid argument against accounting on the blockchain, such issues are addressed by Dai and Vasarhelyi (2017). As they state in their article, the permissioned blockchain could still achieve high levels of security by distributing permissions on different job functions and verification done by accountants, management and auditors.

ANALYSIS

EFFECTS ON THE FIRM

By implementing a triple-entry accounting system onto the blockchain, firms could experience a major shift in their internal financial processes and could fundamentally change their dynamics with external stakeholders. While the exact effects of blockchain accounting are still unknown, some of the major benefits may come in automation and trust:-

- Firstly, firms could leverage the huge automation potential from the blockchain for not only cost-savings but major innovations in payment / invoicing and opportunities in real-time accounting.
- Blockchain solutions such as Request could incorporate invoicing, payments and accounting, all in one simultaneous action. This could move all three actions into one, thus reducing the administrative burden and removing the need for balancing accounts, tracking accounts liable and other accounting functions.
- This would create the opportunity for accounting in real-time, as transactions and invoices are accounted as they occur.
- Transactions could incorporate smart contracts for both automated tax filings and conditional payments. Automatic tax filings not only remove administrative needs but could also allow for dynamic payroll taxes.

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- With blockchain solutions and smart contracts, such conditions could be easily presented in digital invoices and could, once accepted, be fulfilled automatically based on certain conditions such as timing or the receival of goods. This could open up new possibilities in B2B transactions, incorporating complex systems and payments for everyday transactions.
- The benefits from triple-entry accounting and the innate security features of the blockchain could also increase trust within a firm. Because of the immutability of the blockchain, altering or omitting data in a firm's accounting becomes close to impossible, thus reducing risks of manipulations.
- The real-time aspect of blockchain accounting could further reduce these risks as wrongful entries would be instantly visible. Since entries can be viewed instantly by the company and its auditors in real-time, the time-delay between entry and review is minimized, and wrongful entries are instantly visible and virtually impossible to erase.
- the triple-entry system proposed would allow for better confirmations of invoices and transactions. Instead of proving their transactions using receipts and invoices, firms and auditors could confirm transactions digitally in the third, blockchain entry. Receipts and invoices today can be forged or falsified with limited possibility for validation and traceability.
- The suggested third blockchain entry would allow for quick and easy cryptographical confirmations that would mitigate these risks and ensures a match between payable and receivable.

EFFECTS ON STAKEHOLDERS

AUDITORS

The triple-entry blockchain accounting system could give auditors instant access to the full population of transactions, in real time. This feature could be integrated with smart contracts to generate instant access to new forms and representations of information that has not been possible with traditional ERP databases. Substantive tests could be replaced with comprehensive tests, thus increasing the validity of audits dramatically. These innovations could mean a transformation in the audit profession, moving from individual assessments to developing comprehensive testing algorithms.

Going from testing toward smart audits may mean a transformation of the audit industry. A move towards system development and IT-consulting may be the exact path that audit firms

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turn towards to retain their business, thus continuing their work of assuring the validity of accounting.

The literature suggests that the implementation of smart controls should not only prevent such errors but to also be developed to detect any fraudulent or damaging activity. Today, damaging activities are primarily detected in retrospect during an audit, however, smart controls could allow for the automatic detection of these in real-time. This moves the detective work of audit from the reactive sphere to the proactive one.

The role of auditors may hence make a dramatic shift from reviewing accounts towards co-development and consulting in the creation of blockchain accounting systems. This removes dull and redundant tasks from the audit profession and increases the trust in the audit. It may also move the role of auditors much closer to management as they would be working together to develop such systems.

Moving auditing toward IT- and risk-consulting may offer interesting opportunities for established auditing firms, particularly those with existing IT-departments. However, this move requires extensive knowledge of blockchains, cyber-security and IT.

New entrants such as IT-consultancies may enter the audit business, benefiting from their comprehensive knowledge in key fields such as cyber-security. Nonetheless, both of the proposed scenarios put significant pressure on the auditing industry and profession, forcing all actors to adapt to new digital demands.

BANKS

Some of the primary functions of traditional banks today lie within payments and lending. With payments removed from the equation, banks could lose significant parts of their business and would thus lose some power and insight into a firm's operations. This loss of insight and power over transactions may, however, be compensated in the area of credit. As was detailed by Byström, a bank's ability to assess credit risks is increased with the emergence of real-time accounting facilitated by blockchain technology.

With a shift from payments to credit and finance, the banking profession could experience a shift similar to the one described in auditing. Payments and transfers are fairly simple and redundant tasks that banks might be just as happy without. By moving toward complex services within credit, banks could help firms by creating interesting solutions in smart finance that integrates directly on the blockchain. This could take the role of banks closer toward financial consultancy and away from providing simple services such as transfers.

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However, just as in the audit profession, this may have serious implications for individuals working in banking today.

As more complex services emerge in blockchain financing, these will likely be digital and rely heavily on knowledge in IT and blockchain. Traditional strengths could be rendered useless by the blockchain revolution and many jobs on the payment side of banking could be displaced. Bank tellers, customer service agents and other simple jobs could become superfluous in a financial system driven by blockchain.

TAX AUTHORITIES

The innate features of the blockchain and blockchain accounting create massive opportunities for tax collection. Blockchain accounting offers immutable, secure and real-time information that could be automatically reported and collected by tax authorities, and could offer a step-up from today's system which relies heavily on self-reported data. By reducing reporting needs and creating smart solutions, taxation could be made more efficient and secure.

Through automated tax filings and real-time accounting, taxes could be instantly collected with a transaction. This removes both the risk of human errors and inaccuracies and removes the time delay between payment and their subsequent reporting / collection, making the process simpler and more efficient. This not only reduces the administrative issues associated with reporting, but could also reduce the risk of missed tax payments and unpaid taxes by fraudulent or bankrupt firms.

The triple-entry blockchain system could also provide new opportunities in verifying transactions and reducing risks of fraud. As taxes today are primarily accounted for through digital / paper invoices, they can be difficult to confirm and are easily forged, however, these risks are mitigated with blockchain accounting. With third-entry confirmations, verifications could be easily checked with the transacting party, making forged invoices virtually impossible. While valid invoices could still be created with bad players or sidebusinesses, detecting and subsequently tracing such transactions would be significantly easier on a blockchain than on a paper trail.

Here, as well, tax authorities would need significant knowledge in blockchain technology, IT and cyber-security to implement smart taxes and develop controls to detect fraud. The transition to blockchain accounting could decrease administrative burdens dramatically and would move the chase for fraud away from reactive-, to proactive measures and controls. The complex knowledge required, combined with the automation of administrative tasks, puts jobs at risk. Legal knowledge would still be essential in developing appropriate systems that

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intersect tax laws with blockchain controls, however, it could nonetheless move the profession closer to IT.

CONCLUSION

Discussing the research questions of this research may provide some initial guidance and identification of key areas that will be impacted by blockchain accounting and their effects on businesses, stakeholders and professionals. Individual firms can experience benefits in automation, fraud prevention, increased trust in accounting and possibilities for more complex business transactions. These are all benefits to the firm and do not appear to entail comprehensive restructuring beyond that of individual accounting processes. Stakeholders, however, appear to stand before transformations on the industrial scale and could shake the core of their operations. If the blockchain accounting revolution materializes, auditors, banks and tax authorities will see large-scale automation of administrative jobs and a shift toward IT-based operations. Both auditors and banks will take on more consulting-type roles, helping the firm develop and maintain the proper systems, and all above discussed stakeholders will essentially have to develop competencies in blockchain and IT. This puts a strain on industries, individual firms and the professionals within them. As traditional skills become obsolete, demands will shift toward digital knowledge in the sectors.

Proposals of a triple-entry system have been around for some time, however, have not been technically feasible or practically useful, until recently. As the blockchain revolution develops, the accounting sphere identifies its place in the revolution with promising potential. The limited research that has been done on the topic points toward benefits in not only automation, but also real improvements in the security and validity of accounting. The developments in the sphere of accounting have been limited since the introduction of double-entry accounting. While ERP-systems and the digitalization of accounting have offered many benefits and efficiencies, they still rely on the same old double-entry system and are thus susceptible to many of the same risks and inefficiencies as the centuries-old system. The importance and contribution of this research hence lie in the comprehensive effect analysis and its predictions as it closes some of the knowledge gaps detailed in previous studies and helps guide further research in this unexplored topic. By answering the research questions, this research has aimed to fill some knowledge gaps in existing literature. The analysis and conclusions of this research provide initial predictions on the key areas blockchain accounting will impact and their effects on businesses, stakeholders and professionals.

LIMITATIONS AND FURTHER RESEARCH

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The purpose of this research was to study the use of blockchain accounting in a triple-entry system, and its effects on the firm and its key stakeholders. It aimed to find answers by conducting a relevant literature review of the topic, a case study of a prominent project and a final analysis of the firm and its stakeholders. Because of the qualitative approach, the thesis is susceptible to subjective opinion throughout. Furthermore, due to limited previous research and early stages of the technology, little can be said on the topic with certainty and all conclusions drawn in this thesis are therefore speculative.

As the purpose of this thesis was to study blockchain accounting in a triple-entry system, it is limited in its scope and conclusions to only triple-entry systems. Although this appears to be the most prominent method for blockchain accounting today, it was not exclusively designed for the blockchain system, and may not necessarily be the optimal accounting solution. Future research may therefore explore other methods of blockchain accounting and thus compare Grigg's system to others in the blockchain context.

As the stakeholder analysis concludes, many of the stakeholders will have to implement smartcontracts into their operations, with auditors needing smart controls, banks with smart risk analysis and tax authorities making smart taxes. These are still highly uncharted territories in research. Academia could thus greatly benefit from a detailed analysis of how, and where, such smart-contracts would be implemented. Future research could also make further deeper investigations into how such developments will affect job functions in the future, as complex jobs are predicted to take over simpler ones.

Whatever emerges from the blockchain revolution, it is obvious that it could have dramatic effects on entire industries, and could progress faster than expected. Moving accounting from a centuries old double-entry system to an automated triple-entry system could mean a massive shift for all parties concerned by the accounting process. Even if blockchain accounting fails to overtake established practices, it is probable that the accounting process still becomes further automated, relevant, truthful and digitized with normal developments. This hence leads to similar consequences as those discussed above on blockchain accounting. To prepare for such advancements, it is essential for researchers to pioneer the exploration and understanding of such topics and their consequences for the entire financial system.

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