Blockchain-based auditing, effectiveness for accounts receivables and compliance gaps towards relevant audit standard AU-C 505

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**Abstract**

Digitalization provides challenges for audit firms to adapt automated audit and advisory services. This article deals with the suitability of blockchain technology to perform regular external audits of financial statements. The potential of the blockchain in auditing is researched by analyzing, if the balance sheet positions of accounts receivables and the blockchain technology are suitable to eliminate weaknesses of traditional substantive auditing procedures that require external confirmations. Later, it is evaluated if blockchain-based auditing complies with the GAAS standard AU-C 505 “External Confirmations” that rules manual procedures or if new audit standards have to be codified. Based on a qualitative study, the literature research findings are verified by collecting primary data through interviews. The blockchain technology is highly efficient and effective. At the same time, audit firms must refine their business models, and auditors must rethink their role in a future blockchain-based audit environment. In contrast, adequate audit standards must be codified for auditing accounts receivable.

Key words: Blockchains, Effectiveness, Technology, US GAAS

**Introduction / Overview of the Research**

This article evaluates, if the blockchain technology constitutes an appropriate tool for business purposes[[1]](#footnote-1). Furthermore, the study is analyzing if it is able to enhance audit procedures[[2]](#footnote-2). Special focus lies on the analysis of blockchain-based auditing towards the balance sheet position accounts receivable[[3]](#footnote-3). Research is performed, if blockchain-based audits are able to compensate drawbacks of traditional audit procedures, that are work and cost intensive, and not even cover all relevant accounting data[[4]](#footnote-4). A further problem is analyzing, if blockchain-based audits comply with the requirements of the General Accepted Auditing Standards (GAAS) framework[[5]](#footnote-5).

Dai and Vasarhely (2017) provided an early discussion on the blockchain technology, how it could enable a transparent verifiable accounting ecosystem under real-time conditions[[6]](#footnote-6). According to Dai and Vasarhely (2017), the blockchain technology empowers the potential to disrupt contemporary substantive auditing procedures by an automatic audit approach[[7]](#footnote-7). Bonsón and Bednárová (2019) outlined, that technological developments such as the blockchain technology have the power to change our business and social life over a time-span of decades, by providing insight into the functionality of the blockchain technology and its potential impacts on auditing and accounting[[8]](#footnote-8). The innovation of smart contracts for blockchain systems, that enable automated transactions on the blockchain, when pre-defined rules are met, are prescribed by Rozario and Thomas in the year 2019[[9]](#footnote-9). In addition to smart contracts, smart audit procedures enable automated audit procedures, that enhance the effectiveness audit procedures and their results[[10]](#footnote-10). External audits by blockchains aim to improve the audit quality and reliability[[11]](#footnote-11). Vincent et al. (2020) outlined specific requirements for blockchain architecture, thus it is enabling auditors to leverage this technology to provide high quality audit and assurance services[[12]](#footnote-12).

**Potentials of Blockchains for Auditing**

The emerging blockchain technology has the potential to disrupt and to overcome weaknesses of the traditional auditing procedures, by enabling permanent auditing procedures almost in real-time based on automated tools for data analysis with direct access on all relevant data, while transactions are authorized by all nodes, are immutable and traceable[[13]](#footnote-13). Furthermore, blockchains require an appropriate architecture as amendment to existing ERP systems, that is based on a decentralized peer-to-peer network of servers, respective nodes[[14]](#footnote-14). By application of blockchains, accounting is enhancing to a triple accounting system, a digitally signed receipt serves as a medium to perform the mutual authorization of transactions and to verify that the transaction has been performed as specified upfront to avoid fraud on the transaction, and to reduce any redundancies in bookkeeping[[15]](#footnote-15). Audit procedures based on a federated blockchain with a zero-knowledge proof protocol that provide the potential to facilitate a collaborative auditing and cross-party verification, in an economic environment in which auditors take fees to compete for clients, whereby clients determine the level of misstatement in anticipation of the auditing intensity[[16]](#footnote-16). In a distributed ledger, these authorization and verification are fulfilled by a group of peers, whereas no central authority is required[[17]](#footnote-17).

Smart contracts provide the potential of replacing a trusted third-party auditor by testing autonomous approval processes[[18]](#footnote-18). Smart contracts depict computer codes that are stored on a blockchain with the purpose to execute transactions under pre-defined conditions, without human interventions[[19]](#footnote-19). Concerning accounts receivable, the smart contract provides information for the buyer, and furthermore about the quality and the location of the ordered goods[[20]](#footnote-20). If a contract is settled, the goods are delivered, and the supplier records accounts receivable until the payment is transferred[[21]](#footnote-21). In the blockchain, the supplier and the buyer use the same base, while inefficiencies toward the reconciliation of accounts or the request for paper-based or electronic confirmations will become obsolete[[22]](#footnote-22). Auditing on the blockchain is performed by smart audit procedures, that are designed to perform autonomous audit activities that include autonomous tests of internal controls and performing of autonomous analytical procedures[[23]](#footnote-23).

**Problems and downfalls of Blockchains**

A critical issue towards a wider adoption of the blockchain technology lies in the requirement of sufficient and appropriate training for auditors and their staff to enable them to apply the blockchain appropriately[[24]](#footnote-24). Further issues concern the interoperability among different blockchains, as a key feature for the functioning of the blockchain technology[[25]](#footnote-25). In the existing blockchain systems, the need for interoperability was hardly considered by the developers[[26]](#footnote-26). Auditing of transactions in a blockchain does not guarantee that accounting based on the blockchain assures reliable financial reporting, as agreed and verified transactions on the blockchain could be based on fraudulent agreements, misleading transactions or by omission of transactions[[27]](#footnote-27). Thus, blockchains require effective internal controls that ensure the integrity and completeness of data[[28]](#footnote-28). As data in the blockchain do not assure the reliability of a company´s financial reporting, the effectiveness of the internal controls that are surrounding the blockchain has to be tested by auditors[[29]](#footnote-29). The focus of auditors when auditing of accounts receivable e.g. will no longer be on testing of transactions directly, but on the testing of the internal controls to obtain the appropriate assurance, that the recorded transactions on the blockchain are reliable and accurate[[30]](#footnote-30).

The use of blockchain technology and the emergence of new blockchain-based techniques and procedures are placing new demands on both the role and skills of CPA auditors[[31]](#footnote-31). To cope with new techniques and requirements, auditors must acquire new sets of technical and IT skills for auditing of blockchains[[32]](#footnote-32). CPAs must learn a technical programming language and study the main functions of a blockchain system[[33]](#footnote-33). Due to the mere automated audit procedures, some substantive audit procedures towards the testing of transactions will be replaced by smart contracts[[34]](#footnote-34).

There are many questions that arise when dealing with the blockchain auditing:

1. How must blockchain technology be implemented and designed to serve as a suitable progressive tool to perform independent and independent audits?
2. How can blockchain technology be designed to audit the balance sheet positions of accounts receivables to be more effective than traditional substantive auditing procedures, in which external confirmations become obsolete?
3. Is blockchain-based auditing towards accounts receivable compliant with the codified GAAS standard AU-C 505, which regulates external confirmations?
4. Are any amendments towards AU-C 505 required?

The main research objectives[[35]](#footnote-35) of the doctoral thesis are to determine the characteristics of the blockchain technology, to analyze the suitability and appropriateness of blockchains for auditing purposes[[36]](#footnote-36), to verify the superiority of blockchain-based auditing of accounts receivable in contrast to manual audit procedures[[37]](#footnote-37) and to identify the regulatory gap of the current GAAS regulation under AU-C 505 for blockchain-based audits of accounts receivable[[38]](#footnote-38).

**Theoretical Framework of Auditing and Blockchain**

Auditing with blockchains is related to the topic of business and finance[[39]](#footnote-39). The sub-topic of the research is the area of accounting. Businesses require accounting systems to collect and process the financial information of their business[[40]](#footnote-40). The Generally Accepted Accounting Principles (GAAP) determine rules and regulations for financial statements[[41]](#footnote-41). GAAP rule the recognition and presentation of financial information[[42]](#footnote-42). Financial statements that consist of balance sheet, income statement, statement of cash flows, and statement of retained earnings are prepared quarterly or annually[[43]](#footnote-43). To ensure the accuracy of the financial information, companies establish an internal control system to monitor accounting related processes[[44]](#footnote-44). The sub-sub-topic is the area of auditing. To confirm the orderly and correctness of financial statements and the internal controls, companies engage auditors[[45]](#footnote-45).

GAAS that constitute the theoretical framework of blockchain based auditing, are consisting of General Standards, Standards of Fieldwork and Standards of Reporting in the AU Section 150[[46]](#footnote-46). GAAS are a set of systematic principles and guidelines, that have to be followed by auditors in general, when performing audits of financial statements[[47]](#footnote-47). The framework for auditing of accounts receivables is codified under GAAS standard AU-C 505[[48]](#footnote-48).

Blockchains consist of decentralized frameworks[[49]](#footnote-49). They are based on a software solution that simplifies the development, provision and the support of technically complex products[[50]](#footnote-50). The framework includes the infrastructure and the libraries as basis to develop the relevant application[[51]](#footnote-51). The network infrastructure consists of the nodes and the software that runs on them on a peer-to-peer structure[[52]](#footnote-52). The software provides functions and capabilities such as user identity, transaction details, or the consensus protocol, and controls the identity management for blockchains[[53]](#footnote-53). The client application interacts with the infrastructure, and serves as an interface outside, and consists of the code[[54]](#footnote-54), that runs a smart contract[[55]](#footnote-55).

The theoretical framework of the dissertation consists of the blockchain as technical infrastructure and basis[[56]](#footnote-56), and the GAAS standards that regulate auditing procedures under GAAS[[57]](#footnote-57).

**Main contributions of the research/research gaps**

The value of the research is to eliminate the weakness of current audit procedures in general and in particular towards audit of accounts receivable. The purpose of the research approach is adding knowledge to the academic body, guidance for audit firms how to implement and operate blockchain-based auditing, to outline the efficiency of blockchain-based auditing towards accounts receivables for auditing firms and to provide information for standard setters concerning regulatory gaps by blockchain-based auditing. The research gap of the article refers to the lack of regulation concerning blockchain-based auditing towards accounts receivable, as the audit standard under GAAS AU-C 505 “External confirmations” that is relevant for auditing of accounts receivable, is concerning purely manual audit procedures[[58]](#footnote-58);[[59]](#footnote-59). As a conclusion, new sets or modified audit standards are required for auditing of accounts receivable[[60]](#footnote-60).

**Conceptual Background of the Study / Literature Review**

**The positioning of the research in the field of study**

Auditing with blockchains is related to the topic of business and finance[[61]](#footnote-61). The sub-topic of the research is the area of accounting. Businesses require accounting systems to collect and process the financial information of their business[[62]](#footnote-62). The Generally Accepted Accounting Principles (GAAP) determine rules and regulations for financial statements[[63]](#footnote-63). GAAP rule the recognition and presentation of financial information[[64]](#footnote-64). Financial statements that consist of balance sheet, income statement, statement of cash flows, and statement of retained earnings are prepared quarterly or annually[[65]](#footnote-65). To ensure the accuracy of the financial information, companies establish an internal control system to monitor accounting related processes[[66]](#footnote-66). The sub-sub-topic is the area of auditing. To confirm the orderly and correctness of financial statements and the internal controls, companies engage auditors[[67]](#footnote-67).

**Research Design and Methods / Methodology**

**Methodological qualitative approach**

Suitable research methodologies follow the model of Saunders´ research onion[[68]](#footnote-68). The philosophy of the research can be based on the theory of positivism, as it enables the researcher to operate in an observable social reality in order to generate law-like generalizations and to produce unambiguous and accurate knowledge[[69]](#footnote-69). The collection of data shall be performed by an induction to explore the blockchain technology as phenomenon by the identification of themes and patterns with the purpose to create a conceptual framework[[70]](#footnote-70). The methodological approach may be performed as qualitative research to establish theories, search for patterns or theories out of special themes or categories, and analysis of data from special themes or categories[[71]](#footnote-71). A qualitative research is most suitable for the research project, as it involves various approaches to investigate a specific subject, to identify relevant characteristics of this subject in order to make an objective judgment about the subject without adopting a subjective point of view of the researcher[[72]](#footnote-72). An appropriate research strategy follows an ethnography, a form of field research that seeks to learn the culture of a particular setting or environment, while it relies on researcher´s observation through field work as semi-structured interviews[[73]](#footnote-73).

**Research Data**

The evidence to support the findings and conclusions, as well as the need to research the problem and the literature gap may be obtained by the research of primary and secondary sources[[74]](#footnote-74). The literature research can be based on a qualitative study by researching secondary data in form of articles in renowned journals that are providing an appropriate way to examine the requirement for blockchain-based audits, publications from BIG four accounting firms, audit standards and publications from standard setting bodies AICPA and Accounting Standards Board (ASB)[[75]](#footnote-75). Secondary data is based on information that has been collected by other researchers and is been provided again for other researchers to make use of it[[76]](#footnote-76). Secondary data is not static over time[[77]](#footnote-77). Potentially, new sources are created while former common sources of content will be obsolete by time, as survey data may be outdated before it is published and available for other researchers[[78]](#footnote-78). The sources for secondary data can be be extracted from public available sources[[79]](#footnote-79). Secondary data provides researchers with a wide range of information available to conduct their own research on primary data based on proven and reliable materials[[80]](#footnote-80).

The main advantages of secondary analysis in research are the cost-effectiveness and the convenience of collecting data and information[[81]](#footnote-81). Secondary data from academic journals and papers are peer-reviews in general[[82]](#footnote-82). Secondary data is a valid tool to elaborate potential relationships between variables under research[[83]](#footnote-83). The importance of secondary data is to create a context for the primary data that is collected after performing the literature research, thus, the researcher is enabled to compare the results of the own research with research results of other researchers and authors[[84]](#footnote-84). Disadvantages regarding secondary data are found in a lack of customizability and potential bias of its researchers as the data was collected with priorities of these researchers[[85]](#footnote-85).

Primary data can be characterized as original data or information that is being collected directly by the researcher[[86]](#footnote-86). Primary data can be collected by a direct research approach for the specific purpose to perform a particular research project[[87]](#footnote-87). Primary research aims to answer questions that have not previously been answered or even asked, while the degree of originality differentiates primary research from secondary research[[88]](#footnote-88). Primary data can be collected by the researcher by performing a specific plan that is based on a questionnaire with the intention to verify the statements detected from the research of secondary data[[89]](#footnote-89). The procedures for collecting of primary data address the design of the questionnaire, and suitable sampling methods[[90]](#footnote-90). Furthermore, the collection of primary data is related to the underlying research questions of the doctoral thesis[[91]](#footnote-91). The results of the literature research are evaluated with the results of interviews[[92]](#footnote-92) with an appropriate number of auditors that provide sufficient experience with IT-related audits and the impact of the blockchain technology on the audit profession and the role of the auditor.

**Techniques of analysis**

Literature review and semi-structured interviews are among the most commonly used forms of qualitative research[[93]](#footnote-93). Data analysis may be performed by tools as Atlas.ti for the literature review, and by MAXQDA towards the interviews [[94]](#footnote-94). Data from the literature review is analyzed by a content analysis to classify the data, whereby Atlas.ti is searching for particular texts, where the relevant topic appears[[95]](#footnote-95). A suitable analysis of the interviews can be performed by a narrative analysis[[96]](#footnote-96). The results of the interviews are documented, checked and analyzed and compared with the results of the literature review for verification[[97]](#footnote-97). The process of data analysis towards the literature review and the interviews can be done by coding[[98]](#footnote-98), while data is being extracted and sorted[[99]](#footnote-99). Coding allows comparisons with other segments of data[[100]](#footnote-100). A first-order analysis shows similarities or differences between the different aspects[[101]](#footnote-101). It serves to identify patterns in the data to clarify the research questions and the reviewed literature[[102]](#footnote-102). Similarities between data are identified by second-order themes[[103]](#footnote-103). Finally, different motivational drivers are grouped into aggregated dimensions[[104]](#footnote-104).

**Discussion**

**Key findings**

The introduction of blockchain technology in the audit area leads to increased efficiency during the audit process, as the existing information has a higher degree of verifiability due to the blockchain-specific controls and mechanisms[[105]](#footnote-105). Another advantage of the blockchain is the reduction of the audit risk[[106]](#footnote-106). Transactions are continuously recorded in the blockchain[[107]](#footnote-107). A complete audit trail and a history of articles for these transactions can be generated from this[[108]](#footnote-108). Documents can even be shared and made available among related parties for cross-validation[[109]](#footnote-109). The greatest advantage of blockchain technology lies in the establishment of smart contracts[[110]](#footnote-110). Smart contracts are computer codes stored in the blockchain that carry out predefined actions under certain conditions and criteria[[111]](#footnote-111). By applying smart contracts, manual tasks can be automated, which can result in an improvement in the speed, accuracy and cost efficiency of accounting-relevant transactions in accounting but also and can serve in auditing as a basis for smart audit procedures or the independent analysis of audit evidence[[112]](#footnote-112). With smart audit procedures, fictitious, unauthorized or incorrect sales contracts can be distinguished from actual sales contracts[[113]](#footnote-113). Since transactions in the blockchain are recorded automatically, encrypted and unchangeable, it is already expected that they will become the source of truth or auditing and accounting purposes[[114]](#footnote-114).

Traditional audits dos not carry out a full audit but pursues a risk-oriented audit approach based on a selected random sample, where such an audit approach can only offer sufficient certainty, but not an absolute guarantee[[115]](#footnote-115). In the blockchain system are the above problems and risks solved[[116]](#footnote-116).

As data in the blockchain do not assure the reliability of a company´s financial reporting, the effectiveness of the internal controls that are surrounding the blockchain has to be tested by auditors[[117]](#footnote-117). When auditors examine a specific blockchain, they have to consider the blockchain code quality, any protocol changes, and the power allocation among the blockchain peers[[118]](#footnote-118). The focus of auditors when auditing of accounts receivable e.g. will no longer be on the testing of transactions directly, but on the testing of the internal controls to obtain the appropriate assurance, that the recorded transactions on the blockchain are reliable and accurate[[119]](#footnote-119). While previously the occurrence of a transaction had to be confirmed, no further evidence of the nature of such a transaction would be required once it was added to the blockchain network[[120]](#footnote-120). Obtaining external confirmations is no longer required in the blockchain system, which is all financial Information has been verified by other nodes, and the data is verifiable and irreversibly stored in the blockchain[[121]](#footnote-121).

Auditors can fully trust the financial data of the blockchain, thereby reduce many unnecessary auditing procedures and shorten the audit time, which significantly reduces the personnel costs and the resources that are required to check the reliability of the financial information[[122]](#footnote-122).

**Main propositions supported by the literature**

Below is an overview on the main propositions of the literature review:

1. Blockchains improve traditional audit procedures[[123]](#footnote-123).
2. Unless a majority of the users of the blockchain collude, transactions are basically immutable[[124]](#footnote-124).
3. Auditors require effective and reliable tools that offer the necessary and expected level of security in the course of their audit activities[[125]](#footnote-125).
4. The blockchain technology offers a more transparent and safer way to operate the companies´ business data[[126]](#footnote-126).
5. Risks of incorrect financial data are significantly reduced, as incorrectly entered data will not be approved by other nodes[[127]](#footnote-127).
6. Blockchains lead to an increased audit efficiency, as information has a higher degree of verifiability due to the specific controls and mechanisms[[128]](#footnote-128).
7. The greatest advantage of blockchain technology lies in the establishment of smart contracts[[129]](#footnote-129).
8. Obtaining external confirmations for audits of accounts receivable is obsolete in blockchains, as all financial Information has been verified by other nodes, and data is verifiable and irreversibly stored in the blockchain[[130]](#footnote-130).

**Place of the study within the context of previous studies**

This article provides an exploratory research on the suitability of the blockchain technology as an appropriate tool[[131]](#footnote-131), the higher effectiveness for auditing of accounts receivable in contrast to traditional substantive procedures[[132]](#footnote-132), the compliance gap of blockchain-based audits with the codified GAAS and in particular audit standard AU-C 505[[133]](#footnote-133), and the future role of the auditor[[134]](#footnote-134). The study is based on a literature review[[135]](#footnote-135). By collecting of data and information the current status of the blockchain technology in the area of auditing is presented within the doctoral thesis. Furthermore, the research shows the superiority of automated blockchain-based auditing on the balance sheet position accounts receivable[[136]](#footnote-136). The study identified a literature gap towards GAAS standard AU-C 505, when auditing accounts receivable with blockchains[[137]](#footnote-137).

**Conclusion**

Traditional substantive auditing procedures and the classic role of the auditor are being critically questioned in this doctoral thesis[[138]](#footnote-138). The focus of the doctoral thesis is on blockchain-related audits in regard to the balance sheet position accounts receivables, as it provides the disruptive potential to eliminate weaknesses of traditional substantive audit procedures[[139]](#footnote-139). The blockchain technology allows a timely examination of potential errors within accounting entries and the automation of the transaction verification by using data from business partners[[140]](#footnote-140). Whereby smart contracts encoded with accounting and business rules could improve the controls towards the recording process[[141]](#footnote-141). As a conclusion on audits of accounts receivable, balance confirmations when auditing accounts receivables could be no longer necessary within a blockchain system[[142]](#footnote-142). Furthermore, with the permissioned blockchain, access to data can be restricted for different parties’ respective roles[[143]](#footnote-143). Triple-entry account systems through blockchain it can be programmed to follow accounting standards and regulations automatically using smart contracts and could even automate tax filings through continuous updates[[144]](#footnote-144). To qualify as a valid tool in the context of auditing financial statements, the blockchain technology must comply with accounting requirements of the IFRS as comparability, relevance, reliability, understandability, timeliness, and true and fair view regarding accrual accounting and revenue recognition for accounts receivables[[145]](#footnote-145). To be carried out orderly, the blockchain technology furthermore hast to comply with relevant IT Governance frameworks[[146]](#footnote-146).

The blockchain technology that is based on a distributed database and several nodes provides several promising features as immutability of transactions, traceability, transparency, and security by rules and controls[[147]](#footnote-147). Nowadays it is still unclear what impact the blockchain Technology will have on the audit profession, but the effects can be expected to be rather significant[[148]](#footnote-148).

**Potential of future research**

Future areas for research can be focusing on all the potential applications of the blockchain technology in the areas of auditing and accounting[[149]](#footnote-149). Further aspects of research may focus on the technology by establishing of an adequate architecture[[150]](#footnote-150). Concerning the complex requirements for auditors and the audit profession, the requirements for standard setter to codify new sets of audit standards and guidelines have to be analyzed in-depth[[151]](#footnote-151).

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