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Manlio D'Agostino Panebianco e Ludovico Mantoan

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How blockchain changes the legal auditing process

Manlio d'Agostino Panebianco¹ e Ludovico Mantoan²

***ABSTRACT:** Globalization and Internet allow a new phase of decentralization in which a new shift and challenge is given by the blockchain technology, in different fields, and even in legal auditing processes.*

This paper aims to explore the potential application of those emerging technologies for audit purposes (through an analysis of risks, opportunities, and consequent effects), and further imagine the future audit paradigm in which these technologies will automatically collect audit evidence, monitor business processes, protect data from cyber attacks, and enable analytical audits.

SUMMARY: 1. Introduction - 2. The legal framework of auditing - 3. What is a blockchain - 3.1. Possible applications of a Blockchain - 4. The new frontier: auditing through a blockchain-based approach - 4.1. Analysis of benefits and weakness - 4.2. Risk Analysis - 5. Expected future impact of blockchain in auditing. Methodologies for determining audit risk - 5.1. How blockchain will change the activities of the Authorities - 5.2. How blockchain will change interoperability amongst different Companies' functions in the frame of MOGC ex D.Lgs.231/01 - 6. Conclusions – References

1. Introduction

One of the most important joint effects of Globalization and ICT evolution concerns relationships, that changed both in terms of quality and

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² Legal Auditor and PhD in Economics and Management.

quantity, due - or thanking - to new way and means of communication, that reduced - and sometimes “cancelled” - distances and time.

As a matter of facts, both and “digital-natives” and “digital-immigrants”³ have a 3D-lifestyle: the “*real dimension*” is the traditional one characterized by direct contact; the second one is the “*digital dimension*”, which is intermediated by the device, internet, apps and generally from new forms of ICTechnology, soon becoming an integral part of the social and labor sphere. These two dimensions are complementary to each other and both produce both social and legal effects, and it is appropriate to consider the second one as the modern and innovative evolution of the first one. The third one, is the “*virtual dimension*” which firstly is unreal, mainly made up of games or avatars, although – to tell the truth - belong to this category those forms of tools that are born “naturally and spontaneously” by the communities on the net, and do not yet have any legal validity (such as virtual or crypto currencies, like BitCoin). For this reason it is appropriate to highlight at least 3 different considerations: since this last dimension is not firstly framed in a previous (legal) context, this should be considered as “*uncertain*” or even devoid of any legal effect; secondly, considering the speed and normal evolution of modern phenomena, any innovative solution is expected that soon will assume a recognized value, thanking to the intervention of a State or a National or Supranational Authority; then, it is important not to identify and confuse the *digital* with *virtual dimension*, creating misunderstanding especially in not specialized citizens, since it would increase the risk exposure to damages and cybercrimes conducts⁴.

To better understand this last circumstance, for example, it is possible to observe the birth and the evolution both of cryptocurrencies and blockchain: as a matter of facts, States, Authorities, doctrine and literature, start from the point that a “virtual currency” since it is unregulated, has no legal values, since it is not issued by a competent Authority, usually issued and controlled by its developers, and used and accepted among the members of a specific virtual community⁵. But considering the ever increasing diffusion and use

³ Prensky M., *Digital Natives, Digital Immigrants*, in *On the Horizon* 9, 2001.

⁴ D’Agostino Panebianco M., *Vivere nella Dimensione Digitale*, Themis Edizioni, 2019.

⁵ European Central Bank, *Virtual Currency Schemes*, 2012.

(both in legal and illegal contexts), National and Supranational Institutions have started a process of containment and - *de facto* - a recognition, at least for maintaining the rule of law.

«The Internet is beginning a new phase of decentralization. After over twenty years of scientific research, there have been dramatic advances in the fields of cryptography and decentralized computer networks, resulting in the emergence of a profound new technology - known as the blockchain - which has the potential to fundamentally shift the way in which society operates»⁶. This is leading to an expansion of a new law framework called *Lex Cryptographia*, which regulates smart contracts and decentralized secure legal data storage.

The same way, the recognition of the this technology, for example by a single Country, is a milestone for all the others: it is the case of Italy, that adopted at the Article. 8 ter co. 1 of the decree-law 14 December 2018, n. 135 coordinated with the conversion law 11 February 2019, n. 12 recognizing the definition and the scope of application of “*Blockchain, Distributed Ledger Technologies, and smart contracts*”, becoming one of the precursors - from the legal point of view - among the various countries, opening up to the various possible applications and uses, in different areas.

Thanking to its main feature of distributed consensus model and to its future possible evolutions and applications, the blockchain technology can be considered as the most important invention since the Internet was born.

Blockchain is the most disruptive information technology of recent years. Although the use of blockchain has been studied in many fields such as banking, financial markets, and government service, its application to accounting and insurance remains under-explored.

«A blockchain can serve as a distributed, irreversible, and encrypted public paper trail that can be easily audited»⁷.

This paper discusses how people mistakenly imagine that blockchain could enable a real-time, reliable, and transparent accounting ecosystem, and

⁶ Wright A., De Filippi P., *Decentralized blockchain technology and the rise of Lex Cryptographia*, in *SSRN*, 2015, p. 2.

⁷ Wright A., De Filippi P., *Decentralized blockchain technology and the rise of Lex Cryptographia*, in *SSRN*, 2015, p. 13.

how it could transform current auditing practices resulting in a more precise, timely, automatic assurance system. However, this paper argues that blockchain will more probably become an efficient ecosystem, but one where honest and fraudulent transactions may not be easily distinguished, resulting in transformative changes to current auditing practices.

Many predict the death of the accountant and the auditor as we know it today⁸. Many imagine intelligent app recommendation systems, designed to enable less experienced auditors to perform analytical audits. The auditor's job might then be reduced to a less involved role, where the auditor, using the planning system and software recommendations, together with other intelligent systems, would become part of a new auditing paradigm: app-based auditing⁹. Looking at the recent evolutionary history of the reviewer, we can indeed see different phases. By 1991, the concept of "Continuous Auditing" (CA) was proposed and its first application was developed for a corporate billing system. Early CA systems aimed to check the data flowing through the system against auditor-defined rules, and trigger alarms when rule-violations were detected. After two decades, CA has evolved into a much broader concept called "continuous assurance"¹⁰, which consists of three main technologies together providing assurance in close to real time: continuous data assurance (CDA), "Continuous Controls Monitoring" (CCM), and continuous risk monitoring and assessment (CRMA). CDA executes continuous and automatic transaction verification in order to provide timely assurance. CCM monitors employees' behaviors against internal control policies for violations¹¹. CRMA focuses on business risk monitoring by identifying significant risks and prioritizing audit and risk management control procedures. These components provide comprehensive, timely, and accurate assurance, preemptively addressing significant risks.

⁸ Yermack D. *Corporate Governance and Blockchains*, in *Review of Finance*, 21, 2017.

⁹ Vasarhelyi, M.A., J. D. Warren Jr, R.A. Teeter, and W. R. Titera, *Embracing the Automated Audit*. *Journal of Accountancy*, in *Journal of Accountancy*, 2014.

¹⁰ Vasarhelyi, M.A., J. D. Warren Jr, R.A. Teeter, and W. R. Titera, *Embracing the Automated Audit*. *Journal of Accountancy*, in *Journal of Accountancy*, 2014.

¹¹ See Kozłowski S., *An Audit Ecosystem to Support Blockchain-based Accounting and Assurance*, in D.Y. CHAN, V.C. and M.A. Vasarhelyi (eds), *Continuous Auditing: Theory and Application*, Emerald Publishing, New York, 2018.

While some technologies have been studied in the auditing domain, a large portion of them remain under-explored, including industry 4.0, blockchain, and auditing apps. To fill the gap in the literature, as well as provide insights into practice, this paper aims to explore the potential application of those emerging technologies for audit purposes, and further imagine the future audit paradigm in which these technologies will automatically collect audit evidence, monitor business processes, protect data from cyber attacks, and enable analytical audits.

2. The legal framework of auditing

Alongside this evolution in revision techniques at the Italian and European levels, interesting regulatory changes have taken place. Regulatory instruments have contributed to achieving greater stability and transparency in the financial system after the 2008 crisis, acting on the leverage of reliability in auditing to strengthen investor protection and confidence in financial markets.

Some consideration about the European and Italian legal framework can help to better understand the context, the implications, and the related impact, although the analysis can be considered generally as a reference point to be extended for other individual Country.

In this regard, the European Commission published the Green Paper on the lessons of the financial crisis for accounting and audit policies in 2010. In particular, in Italy the Legislative Decree n. 39/2010, as amended by Legislative Decree 17 July 2016, n. 135 (transposing the new directive), has been in force since August 5, 2016 and represents the primary regulatory source for all revisions (Chapter V for revisions of Public Interest Entities).

The Regulation (EU) n. 537/2014, directly applicable from 17 June 2016, also sets out specific provisions for the audits of financial entities designated to be in the public interest (listed issuers, banks, insurance and reinsurance companies).

To these regulatory sources are added:

- the previous provisions of the civil code (2409-bis for SpA and 2477 for Srl);

- TUF¹² and Issuers' Regulations for listed companies and sector-specific regulations (TUB¹³ for banks and CAP for insurance companies);
- Italian Minister of Finance (MEF) implementing regulations (in particular, regarding the early termination of the statutory audit engagement, Ministerial Decree 261/2012);
- Italian Auditing Standards (ISA).

Overall, the main principles identified in these legal instruments, passed in an effort to reform and strengthen the reliability of the auditing system, include:

1. greater independence for the auditor;
2. greater organizational and internal control safeguards;
3. greater professional skepticism;
4. greater transparency of the audit process and its results.

In achieving this objective, the reform aims at strengthening the role of the Audit Committee, whose functions in our system are attributed to the Board of Statutory Auditors in the traditional model, to the Supervisory Board in the two-tier structure, and to the Internal Control Committee in the one-tier management system (Article 19 of Legislative Decree 39/2010).

Importantly, recognition was given in regulation to a fundamental concept, already provided for in the Auditing Principles, related to the particular mental attitude that must characterize the auditor in carrying out the audit engagement (new art. 9 D. 39/2010):

- a skeptical approach, constant monitoring of the symptomatic conditions of fraud or errors, and critical evaluation of the documentation;
- recognition of the possibility of a significant error attributable to facts or symptomatic behaviors of irregularity;

to be put in practice, in particular:

- in the review of the estimates provided by management: fair value, impairment of assets, provisions, future cash flows;
- in the verification of the going concern assumption.

However, this legislation may already seem outdated in the context of blockchain. How can these forecasts be adapted to a system governed by

¹² Abbreviation of *Testo Unico della Finanza*, the Italian Financial Legal Framework.

¹³ Abbreviation of *Testo Unico Bancario*, the Italian Banking Legal Framework.

digital code, where the reviewer could be considered a passive observer of otherwise immutable transactions?

3. What is a blockchain

The first description of a “blockchain technology” (also known as “*Distributed Ledger Technology*”) is closely tied with the birth of Bitcoin¹⁴, introducing a new peer-to-peer electronic “cash” interchange system, without the need for a trusted third party (Atzori, 2015)¹⁵: «a blockchain is essentially a distributed database of records, or public ledger of all transactions or digital events that have been executed and shared among participating parties»¹⁶.

«In simple terms, the blockchain can be thought of as a distributed database. Additions to this database are initiated by one of the members (i.e. the network nodes), who creates a new “block” of data, which can contain all sorts of information. This new block is then broadcasted to every party in the network in an encrypted form (utilizing cryptography) so that the transaction details are not made public. Those in the network (i.e. the other network nodes) collectively determine the block’s validity in accordance with a pre-defined algorithmic validation method, commonly referred to as a “consensus mechanism”. Once validated, the new “block” is added to the blockchain, which essentially results in an update of the transaction ledger that is distributed across the network. In principle, this mechanism can be used for any kind of value transaction and can be applied to any asset that can be represented in a digital form»¹⁷.

¹⁴ Nakamoto S., *Bitcoin: A Peer-to-Peer Electronic Cash System*, bitcoin.com, 2008.

¹⁵ Atzori M., *Blockchain Technology and Decentralized Governance: Is the State Still Necessary?*, in *SSRN*, 2015, pp. 10 -17.

¹⁶ Crosby M., Nachiappan, Pattanayak P., Verma S., Kalyanaraman V., *BlockChain Technology: Beyond Bitcoin*, in *Applied Innovation Review*, 2/2016.

¹⁷ Houben R., Snyers A., *Cryptocurrencies and blockchain: Legal context and implications for financial crime, money laundering and tax evasion*, European Parliament’s Special Committee on Financial Crimes, Tax Evasion and Tax Avoidance, 2018.

The main features of this technology is that each information - collected by any registered user in the public ledger - is verified by consensus of a majority of the other participants in the system, and cannot be erased or modified, without leaving any trace, and then being known to the “community”¹⁸.

«The formidable innovation introduced by this technology is that the network is open and participants do not need to know or trust each other to interact: the electronic transactions can be automatically verified and recorded by the nodes of the network through cryptographic algorithms, without human intervention, central authority, point of control or third party (e.g. governments, banks, financial institutions or other organizations). Even if some nodes are unreliable, dishonest or malicious, the network is able to correctly verify the transactions and protect the ledger from tampering through a mathematical mechanism called proof-of-work, which makes human intervention or controlling authority unnecessary»¹⁹.

The Blockchain technology is going to become, in the near future, one of the engine both of digital economy, and of the entire “*digital dimension*”, changing the security level of information and personal data sharing: as a matter of facts, the potential fields of application is illimited, going from Government, healthcare and welfare, Notary, Finance and Insurance, private securities and other financial and non-financial applications.

3.1. Possible applications of a Blockchain

Traditional industrial and financial sectors are currently undergoing a deep metamorphosis: the integration of their business and brand with new technologies. In particular, blockchain is broadly discussed as a paradigm with huge innovation potential in many areas, including finance, government, health, science and education²⁰.

¹⁸ See Bompreszi C., *Blockchain e assicurazione: opportunità e nuove sfide*, in *Diritto Mercato Tecnologia*, 2017.

¹⁹ Atzori M., *Blockchain Technology and Decentralized Governance: Is the State Still Necessary?*, in *SSRN*, 2015, p.2.

²⁰ Tan B.S. and Low K.Y., *Bitcoin: Its Economics for Financial Reporting*, in *Australian Accounting Review*, 27, 2017.

Indeed, «in this context, the blockchain, due to its characteristics, could represent an opportunity for the protection of user data. In the Declaration establishing the European Blockchain Partnership, signed by numerous Member States to cooperate on future developments in the matter by adopting shared approaches, methods and initiatives, it is stated that blockchain-based services will help preserve data integrity and ensure better data management. same data by citizens and organizations that interact with public administrations»²¹.

Many believe that blockchain, like the Internet, will revolutionize how people and organizations will manage transactions and assets. In one part of this issue, numerous articles have predicted the end of accounting and auditing as we know them today. Indeed, since blockchain offers lower costs and faster transaction times, it is not hard to envisage the potential of blockchain going beyond simple cryptocurrency management and exchange, leading to a new concept of business. In this sense, a total change in the paradigms that have always regulated the work of accountants and auditors is conceivable.

One of the earlier uses of such applications was in the financial industry. Any financial transaction between people could be digitized and verified through blockchain, without the need for financial entities for verification. Blockchain can be used among companies and organizations for recording, validating and processing financial settlements. There are other use cases in finance, such as block-based platforms in order to keep track of all trades in stock markets. Many solutions for the insurance industry have also been proposed, such as peer-to-peer insurance arrangements and pay-per-use or micro-insurance.

Smart contracts, for example, «encode relevant terms into a blockchain and execute automatically when predefined conditions are met», essentially programming contractual obligations so that their performance and change is regulated by computer code programmed through a distributed blockchain²².

²¹ See Gambino A. M., Bomprezzi, C., *Blockchain e Protezione dei Dati Personali GDPR*, in *Diritto dell'informazione e dell'Informatica*, 2019.

²² See Schmitz J. and Leoni G., *Accounting and Auditing at the Time of Blockchain Technology: A Research Agenda*, in *Australian Accounting Review*, No. 89 Vol. 29 Issue

By enabling the automation of things like insurance policies, blockchain-based smart contracts can reduce administration costs and increase the efficiency of processes. However, aside from the difference in programming and controlling transactions in advance (smart contracts), and not just mediating and recording transfers of assets (blockchain), the same advantages and risks associated with blockchain also apply to smart contracts, since smart contracts are based on blockchain code²³.

In this sense, the analysis of smart contracts may seem a weak link in the process of auditing, because the work of the reviewer could fit simply into the role of a supervisor that carefully analyzes accounts in order to understand the nature of the transactions. However, this is not where one can conceive of the added value of an external and internal revision process. Indeed, smart contracts can be used for everything, from insurance to the energy industry, where the main use is in micro-grids. Blockchain may also be useful in reducing fraud related to the integrity of a policy or claim. In this sense, the widespread opinion of blockchain is trivial because in the process of committing a fraud, non-existent transactions are conducted outside the blockchain, and the fraud is completed in the transaction in the blockchain²⁴.

Other relevant application fields include healthcare, logistics, manufacturing and the robotics industry, where blockchain technology is expected to improve, optimize and automate several processes. This is partly because of another important feature of blockchain: that it is non-modifiable. Since all transaction information is recorded in blockchain and is not changeable, this feature facilitates auditing because it can be programmed to certify that all transactions and matters are truthfully recorded²⁵. This creates a problem of whether the blockchain will change and facilitate the audit.

2, 2019; Gambino M.A., *Dignità umana e mercato digitale*, in *Diritto Mercato Tecnologia*, 2017.

²³ Gambino M.A., *Dignità umana e mercato digitale*, in *Diritto Mercato Tecnologia*, 2017.

²⁴ See also Bompreszi C., *Blockchain e assicurazione: opportunità e nuove sfide*, in *Diritto Mercato Tecnologia*, 2017.

²⁵ Kozłowski S, *An Audit Ecosystem to Support Blockchain-based Accounting and Assurance*, in D.Y. Chan, V.C. and M.A. Vasarhelyi (eds), *Continuous Auditing: Theory and Application*, Emerald Publishing, New York, 2018.

«A blockchain’s ability to manage data from a variety of untrusted source may further make it a foundational tool for the mainstream deployment of the Internet of Things. The Internet of Things will consist of billions of networked Internet-enabled devices, not all of which can be trusted and some of which may even be malicious. These devices need a central reference point that can help facilitate private, secure, and trust-less machine-to-machine coordination»²⁶.

4. The new frontier: auditing through a blockchain-based approach

In reality, the objective of an audit is to enable the auditor to express an opinion on whether the financial statements are prepared, in all material respects, in accordance with an applicable financial reporting framework. In the assertion level of audit, it is crucial to obtain sufficient and appropriate audit evidence. For example, to confirm a transaction really happened, auditors must collect evidence like invoices, shipping documents, customer orders, or confirmation requests, and in order to do so, businesses must ensure that all relevant information was recorded, accurately, during the correct accounting period, and with the correct classification²⁷. As mentioned above, any transaction in the world of blockchain will be recorded and encrypted, but cannot be falsified. Therefore, the evidence need for an audit can all be simply obtained, and this will eliminate the influence of asymmetric information, reducing the risk of detection. Blockchain is also encrypted, which will help to resist malicious attack and keep the accounting record accurate. In addition, since data-blocks are stored in every node, there is no loss risk. That also means every node which can decrypt the data-block can inquire into the transaction information, so the

²⁶ Wright A., De Filippi P., *Decentralized blockchain technology and the rise of Lex Cryptographia*, in *SSRN*, 2015, p. 14.

²⁷ O’Leary, D., *Open Information Enterprise Transactions: Business Intelligence and Wash and Spoof Transactions in Blockchain and Social Commerce*, in *Intelligent Systems in Accounting, Finance and Management*, 25/2018.

auditing is not restricted by space. Because of non-modifiability of blockchain, it is almost impossible to conduct financial statement fraud.

4.1. Analysis of benefits and weakness

However, blockchain apparently reduces detection risk only if we can be sure that there is no non-existent or fraudulent transaction underpinning the transaction being considered.

Therefore, it is essential that the auditor is able to map the entire blockchain. Once this examination has been carried out, you will have to apply professional skepticism and understand the real economic nature of the transaction. So, it is clear that theoretically, the non-modifiable and time-stamped transaction features of blockchain do support the function of auditing, and allows auditors to easily audit all transaction of their clients.

But this is only true if we can count on a review process that considers all the parties involved in the blockchain. Otherwise, if auditors can only process a part of the blockchain of transactions, the work of the auditor becomes paradoxically useless, since the professional skepticism that must investigate the parties involved in the transactions and the economic nature of the operations cannot be leveraged.

4.2. Risk Analysis

Because data modification in a “public” blockchain²⁸ needs the approval of 51% of participants, normally when the number of participants is big enough, a 51% attack cannot happen because of the costs involved. But this does not eliminate the possibility. With enough malicious participants or a hash value that is short enough, the blockchain may be attacked and data may be modified, causing the detection risk to consequently increase.

²⁸ There is a difference between a “public” blockchain-based methodology in which «all records are visible to the public and everyone could take part in the consensus Process» (Z. Zheng, S. Xie, H. Dai, X. Chen, H. Wang, 2017) and a “private” blockchain-based methodology in which «only those nodes that come from one specific organization would be allowed to join the consensus process» (Z. Zheng, S. Xie, H. Dai, X. Chen, H. Wang, 2017).

Cryptographic keys and anonymous transactions also make blockchain vulnerable in other ways, given that the assets of an online ID are only protected by its private key. If the key is lost, then the assets bound to that online ID are lost. One solution is to build an account and reputation system using a blockchain. This chain would record events like births, schooling, bank accounts and so on. In this way, the other chain becomes a digital identity that is difficult to steal. So, to handle the “ID theft” problem, auditors can only seek an expert’s help.

Finally, the world of blockchain is still independent and unregulated. To prevent the introduction of illegal activities it needs regulations and laws, and especially the cooperation of different countries, when any international trade occurs. While the features of blockchain allow it to prevent fraudulent behaviors, it cannot detect fraud by itself. Existing techniques using machine learning and data-mining algorithms may find new applications in detecting fraud and intrusions in blockchain-based transactions.

Taken together, blockchain technology will, due to its features, facilitate routine audit work while changing the way auditing is done, such as by enabling auditing immediately after a transaction is completed. But the blockchain itself still has some problems to solve, and auditors cannot rely entirely on it. If blockchain technology is adopted widely for use in auditing, to ensure quality control and to facilitate auditing, auditors should consider and assess risks of ID theft, illegal activities, and compromised systems.

The auditors’ professional experience in assessing the accuracy of complex accounting transactions will be aimed at analyzing business processes and the organizational structure of the company.

Despite the elimination of substantive tests on accounting transactions, the real-time availability of accounting data²⁹ offers immense benefits for their reconciliation and therefore allows the auditor to focus on the Information Communication Technology (ICT) system’s compliance tests and on the nature of economic transactions at the corporate base.

²⁹ Fanning K. and Centers D., *Blockchain and Its Coming Impact on Financial Services*, in *Journal of Corporate Accounting and Finance*, 27, 2016.

The advantages of continuous audits, real-time monitoring and the reconciliation of accounting data can be realized only if different blockchains used in customer activities are linked together. With this analysis, the auditors work will be concentrated on understanding the IT infrastructure³⁰.

The only auditing process in the new paradigm that will remain relevant is related to interoperability.

Blockchains do not speak the same language, as different types of blockchains use different consensus models and different transaction schemes. Even in this case, however, the auditor's control will focus on the protocols of the various IT departments that will interface, as well as the organization and the reliability of the various IT systems. It will therefore be possible to imagine auditing principles that will shift to become more oriented to the forensic activity of interrogating the reliability of the internal controls and IT systems.

Multi-chain technology, which allows several independent blockchains to connect and become part of a larger blockchain ecosystem, can actually help auditors open up a world in which resources are easily moved from one blockchain network to another. This would completely unlock the advantages of blockchain technology in major businesses. Multi-chain technologies, like Cosmos and Polkadot, are capable of connecting independent blockchains to develop a decentralized network, make each blockchain a micro-component of a larger system.

Although many legal and technological challenges remain to be solved regarding the use of multi-chain technologies before the blockchain interoperability is ready to be incorporated into registration systems, audit firms should keep pace with current developments in the blockchain ecosystem and focus on the development of procedures for accurate analysis of internal control and IT systems. Exploiting networks of independent reviewers will enable mapping the entire economic process at the base of the used blockchain. In this sense, the reviewer of the future will not be analyzing simple counter reconciliations. They will be an expert in the sector

³⁰ KPMG, *Audit Point of View: The Blockchain Shift Will Be Seismic*, Canada, 2018.

they are reviewing, knowing any related parties of the companies and understanding the nature of the underlying economic transaction in order to ensure there is no underlying fraud or tampering with the underlying assets³¹. In this sense the principles of forensics that will help a serious investigation of the operations can be elevated to principles of revision.

5. Expected future impact of blockchain in auditing. Methodologies for determining audit risk

There are two methods that can be used to determine audit risk, and both are applied in professional practice: the professional or critical method, and the residual risk (statistical) method. They rely on the determination of the intrinsic risk, control risk, and identification (detection) risk. Given the considerations outlined above for the mitigation of identification and control risks, these methodologies converge such that revision risk essentially derives from the critical revision risk. This represents a revolution in the methodology of auditing practices set out and developed in recent decades.

Based on this method, the statutory auditor, after having determined the intrinsic risk and the control risk, weighs them to determine the level of identification risk and therefore the audit risk. At that point, the auditor decides which approach - whether substance or compliance - should be adopted for the items on the balance sheet in question. The statutory auditor, based on his personal "professional and critical" assessment, will be able to assess whether the audit risk is high, medium or low, and therefore there will be no question of revision risk as a method of identifying residual risk through statistical analysis.

The transformative effect of Blockchain lies in the fact that it gives a new emphasis to the professional critical sensitivity of the auditor which can be applied to a wide range of differently sized economic transactions.

³¹ Coyne J. and McMickle P., *Can Blockchains Serve an Accounting Purpose?*, in *Journal of Emerging Technologies in Accounting*, 14, 2017.

5.1. How blockchain will change the activities of the Authorities

There are many advantages that can be seen in the use of blockchain in auditing. First, the lack of a central authority increases trust between people and transparency³². In fact, each computer in the network is able to verify what is happening in the blockchain, decreasing the possibility of corrupt data. Since transactions must reach majority consensus in order to be validated, the problems of double spending and fraud are prevented. Moreover, each computer has a copy of the blockchain, reducing the risk of data loss³³.

«The blockchain technology potentially allows individuals and communities to redesign their interactions in politics, business and society at large, with an unprecedented process of disintermediation on large scale, based on automated and trust-less transactions. This process might rapidly change even the tenets that underpin existing political systems and governance models, calling into question the traditional role of State and centralized institutions» (Atzori, 2015)³⁴.

Although the position expressed by techno-libertarians and crypto-anarchists is extremist, considering «the State as an illegitimate, unnecessary and irremediably obsolete depository of power»³⁵, this technique allow to implement new models that speed up and optimize control activities and contrast to illegal conducts, both in “real” and “digital dimensions”, through the controlled mapping of smart contracts along the entire process. Governance can monitor and analyze data directly accessing to blockchain, reducing inefficiencies, common problems related to possible opacity in decision-making, costs and time to audit and providing a more transparent process, that reducing the human impact on decision would also reduce the impact of conflict of interests.

³² Atzori M., *Blockchain Technology and Decentralized Governance: Is the State Still Necessary?*, in SSRN, 2015, pp. 2;14 – 17; 21.

³³ See Bomprezzi C., *Blockchain e assicurazione: opportunità e nuove sfide*, in Diritto Mercato Tecnologia, 2017.

³⁴ Atzori M., *Blockchain Technology and Decentralized Governance: Is the State Still Necessary?*, in SSRN, 2015, p.4.

³⁵ Atzori M., *Blockchain Technology and Decentralized Governance: Is the State Still Necessary?*, in SSRN, 2015, p.4.

On the other hand, decentralization means reduction of “privacy” and this fact could worry people. However, there exist blockchains that provide more privacy or limit the number of users that can access the network and the information it contains. Another important feature is security. The data stored on the blockchain are unchangeable and each block can be traced going back through the chain. Because of this, it is easy to verify attempts to commit fraud.

Since everything is stored in a unique decentralized public register, we also don't need third parties or private institutions, decreasing costs and increasing the speed of transactions. High security also has drawbacks. Transactions are public to those who have access to the relevant public keys, but transactions themselves cannot be modified or canceled. Thus, if someone makes a mistake, for example sending money to the wrong person, that transaction is lost. For the same reason, if someone gets access to a private key and is able to conduct transactions, they will be able to divert funds and it will not be possible to retrieve them. Maintaining a private key is also critical, since losing it would mean losing access to the property associated with it.

«A blockchain's coordinative power is not solely limited to facilitating the action of machines. It also allows for the execution and interconnection of a variety of smart contracts that interact with one another in a decentralized and distributed manner. Multiple smart contracts can be bound together to form decentralized organizations that operate according to specific rules and procedures defined by smart contracts and code - thereby transforming Michael Jensen's and William Meckling's theory that entities are nothing more than a collection of contracts and relationships into reality»³⁶.

In practice, these issues are avoidable (or at least can be mitigated) with the correct design of any blockchain network³⁷. However, the more

³⁶ Wright A., De Filippi P., *Decentralized blockchain technology and the rise of Lex Cryptographia*, in *SSRN*, 2015, p.15.

³⁷ Wang Y. and Kogan A., *Designing Confidentiality preserving Blockchain-based Transaction Processing Systems*, in *International Journal of Accounting Information Systems*, 30, 2018.

institutions accelerate their rate of implementing blockchain, the stronger and more pervasive changes, and associated risks, will become. Early awareness in the auditing profession will be necessary to prevent businesses from adopting systems that are not functional for their needs, including auditing requirements³⁸.

Taken together, stakeholders will be more closely connected through blockchain accounts or blockchain-enabled smart contracts. This, however, does not guarantee any improvement in transparency or function. The functionality, usefulness, or transparency of transactions will depend on the design of any system used. Therefore, how the system is designed will decide if potential auditing risks are mitigated in practice, or only in appearance.

This changes would affect even the audit activity of national and local tax agencies³⁹, since the guarantee of the chain can increase the quality of controls, allowing some more attention to those “anomalies” emerged by automatic checks: as a matter of facts, the interoperability of different chains (such as e-invoicing, e-receipt, welfare, healthcare, etc.), would allow double automatic checks both on the issuer and on service users), without any direct and required human action, at least in the first general phase, that would concern the most population of taxpayers. While on the contrary, Tax agencies can focus only on those cases in which cross data would highlight significant discrepancies, not only comparing just two sources, but all those available.

This can be considered a natural evolution⁴⁰ and a correct application of Blockchain-based technology using Big-Data, that would allow even to reinforce the contrast to some crimes such as (public and private) corruption and bribery⁴¹, increasing the guarantees of transparency in favor to

³⁸ Schmitz J. and Leoni G., *Accounting and Auditing at the Time of Blockchain Technology: A Research Agenda*, in *Australian Accounting Review*, No. 89 Vol. 29 Issue 2, 2019.

³⁹ In Italy, we refers mainly to Agenzia delle Entrate (Tax Agency) and Agenzia delle Dogane (Customs and Border Agency).

⁴⁰ Antonopoulos A., *Bitcoin Security Model: Trust by Computation*, O'Reilly- Radar, 2014.

⁴¹ Wright A., De Filippi P., *Decentralized blockchain technology and the rise of Lex Cryptographia*, in *SSRN*, 2015, p.16.

stakeholders, especially to the weaker parties, reducing even those conditions of informative asymmetry⁴²: as a matter of facts, Blockchain technology allow to increase transparency in favor of stakeholders, since participants interacts without knowing each other, not allowing individual to act illegally and/or hiding conflict of interest: «even if some nodes are unreliable, dishonest or malicious, the network is able to correctly verify the transactions and protect the ledger from tampering through a mathematical mechanism called proof-of-work, which makes human intervention or controlling authority unnecessary»⁴³.

In a future perspective, obviously, the structure of Governments and of Public Administration could be completely modified, up to a new form of tax calculation system as well as collection, and of fiscal control, based on automatic and independent algorithmic rules. «As such, the blockchain could support and facilitate the deployment of a decentralized alternative to the current legal system - a new digital common law - consisting of an interconnected system of rules interacting with one another in a reliable and predictable way, without the need of any third party institution to enforce these rules»⁴⁴.

5.2. How blockchain will change interoperability amongst different Companies' functions in the frame of MOGC ex D.Lgs.231/01

The corporate organization and management model of Italian law (or “model pursuant to Legislative Decree No. 231/2001”, defined in art. 6) indicates an organizational model adopted by a legal person, or association without legal personality, aimed at preventing the criminal liability of institutions.

This legislation, concerning the "*Rules governing the administrative liability of legal persons, companies and associations, including those*

⁴² See A Beccara J.L., d'Agostino Panebianco M., *Privacy Impresa e Banca*, Giuffrè Francis Lefebvre, 2020.

⁴³ Atzori M., *Blockchain Technology and Decentralized Governance: Is the State Still Necessary?*, in *SSRN*, 2015, p. 2.

⁴⁴ Wright A., De Filippi P., *Decentralized blockchain technology and the rise of Lex Cryptographia*, in *SSRN*, 2015, p. 40.

without legal status", has been in force since 4 July 2001. It created in Italian law, in line with European Union law, a new liability regime for the commission or attempted commission of specific types of crime in the interests of or to the advantage of the entities themselves (termed "da reato" in Italian, loosely translated to "by crime" or "through crime" in English).

This organizational model can, and should, form the basis of the auditors approach, which will need to understand the nature of the operations and the criminal risks that could be of interest to an organization.

The Legislative Decree n. 231/2001 defines (article 6, paragraph 2) the content of the organization and management models, providing that they must respond - in relation to the extension of the delegated powers and the risk of commission of the crimes - to the following needs:

- identify the activities in which the crimes may be committed;
- prepare specific protocols aimed at planning the formation and implementation of the company's decisions in relation to the crimes to be prevented;
- identify methods for managing financial resources that are suitable for preventing the commission of these crimes;
- provide record-keeping obligations on the body in charge of supervising the functioning and observance of the organizational model;
- introduce a disciplinary system suitable to sanction the failure to comply with the measures indicated in the organizational model.

If, in a given situation, a crime is committed by the subjects under the management of others, the company does not avoid liability if it proves that the non-compliance with the management or supervisory obligations did not contribute to the commission of the crime⁴⁵.

In this case and any others, liability is avoided if the company, before committing the crime, has adopted and effectively implemented an organization, management and control model suitable for preventing the crimes of the kind that occurred.

⁴⁵ See also Gambino A.M., Romano R., Falce V., Maggio E., Valditara G., Ronco M., Moscati E., *Studi giuridici europei 2014*, Giappichelli, 2016.

In any case, it is useful to specify that, in addition to the opening of an ad hoc prosecution in which the company is considered like an accused natural person, the criminal judge's determination of the company's guilt for the crimes occurs through:

- verification of the existence of the predicate offense for the liability of the company;
- the suitability for the association of the organizational models adopted.

This paradigm of finding businesses responsible for criminal activity conducted for their own interests or advantage should form the basis for the model of auditing that should be deployed for business structures that use the blockchain.

6. Conclusions

In recent years, auditors have effectively applied review techniques derived from statistics. Using sample-based tests, auditors would check accounting balances or internal control systems. The future role of an auditor will not be the same, but it will not be obsolete or be eliminated altogether⁴⁶. Instead, the future role of an auditor dealing with blockchain-based businesses will be that of an investigator of the nature of economic transactions. The future auditor will need to understand the nature of the transactions and parties involved. Forensic methodology will be the new analytical model that will dominate, shifting from a quantitative analysis to a qualitative one.

More than rethinking the work of auditors, this will also require a careful consideration of standards and practices for the integration of blockchain into the financial systems of businesses. Auditors must begin to understand this new terrain in order to play a role in shaping how those standards develop and are applied in a way that works for businesses, facilitates

⁴⁶ Chartered Professional Accountants Canada (CPA Canada), *Technological Disruption of Capital Markets and Reporting? An Introduction to Blockchain*, 2016.

auditing and corporate compliance, and avoids weakening anti-corporate crime laws.

«Given the aforementioned characteristics of blockchain technology, the deployment and mainstream adoption of this technology may require a shift in the way we perceive the role of law. We might need to rethink the mechanisms we use to regulate individuals, and society more generally, in order to grapple with the emergence of this new set of technological rules»⁴⁷.

What described in this paper, mainly concerns a “public blockchain-based methodology” which can guarantee both public (Institutional parties) and private ones (companies): although a possible alternative is the adoption of a “private blockchain-based methodology” which allows to better face and manage the possible rising problems, higher costs, and speed of transactions.

In any cases, the adoption of a blockchain-based methodology (regardless whether “public” or “private” one) lead to an higher transparency and certainty of the quality of data, and a lower risk exposure to economical criminal conducts.

⁴⁷ Wright A., De Filippi P., *Decentralized blockchain technology and the rise of Lex Cryptographia*, in *SSRN*, 2015, p. 44.

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