Blockchain Smart Contracts, Part 2

Applications and Recommendations

Media attention on blockchain exploded in 2021, with major news outlets reporting on governments' adoption of blockchain and associated smart contract systems such as central bank digital currencies (CBDCs) and egovernment. Blockchain smart contracts can be used in novel ways in numerous sectors of the government and the economy, such as in governmental applications, for the creation of new legal entities and by large enterprises, including the Big Four accounting firms.

A recent indication of the growing importance of blockchain smart contracts comes from US Securities and Exchange Commission (SEC) chairman Gary Gensler who, in 2021, stated:

> It doesn't matter whether it's a stock token, a stable value token backed by securities, or any other virtual product that provides synthetic exposure to underlying securities. These products are subject to the securities laws and must work within our securities regime.[1]

The regulation of blockchain smart contracts stems not only from the US regulatory environment, but other countries and the European Union as well.[2]

While the first article of this two-part series,

"Blockchain Smart Contracts, Part 1: Introduction for Accounting and Auditing Professionals," provides a foundational understanding of blockchain smart contract architecture crucial to implementation and business decisions,[3] the discussion herein is expanded to address how blockchain smart contracts are and will be used in the public and private sectors, including multiple open-source blockchain implementations and open-source ecosystems (e.g., Hyperledger projects[4]) currently assisting community contributors to implement smart contract solutions.

SAMUEL ZARUBA SMITH

Is a Ph.D. candidate at the University of Nevada, Reno (USA) and is associated with the university's center for cybersecurity. He has extensive IT experience as a full-time employee, management consultant and researcher for Bank of America, Microsoft, AT&T and the US National Science Foundation. His research interests include artificial intelligence, blockchain, security and distributed systems.

ANDY GARCIA | PH.D., CPA

Is a professor at Bowling Green State University (Ohio, USA). He has worked for a global accounting firm and a Fortune 500 company as an international auditor. Garcia has authored papers published in the *ISACA® Journal,* the *International Journal of Accounting* and *Information Management, Research on Professional Responsibility and Ethics in Accounting,* the *Journal of Accounting Education,* and *Internal Auditing.*

Smart contracts are of growing importance to all accounting and IT professionals, particularly as they have attracted increased regulatory scrutiny; therefore, it is essential for audit, financial and IT professionals to understand how to implement blockchain smart contracts at their organizations.

Governmental Adoption

Blockchain-based CBDCs have been the subject of successful pilot projects in multiple countries. Since 2014, blockchain-based CBDCs have been the subject of successful pilot projects in multiple countries. Those countries that have successful CBDC pilot projects account for the majority of global gross domestic product (GDP). Additionally, CBDCs are under development or being considered in numerous other countries as well. All or most of these CBDCs are expected to be based on private permissioned blockchains, allowing the country's central bank to maintain control over monetary policy. By 2020, 60 percent of the world's central banks, including all of the G20, were experimenting with digital currencies—an increase of 18 percent since 2019.[5] Experts at central banks believe their CBDCs will facilitate cross-border payments, increase the financial inclusion of under financed populations and create more payment system stability. The biggest known risk factors related to CBDCs are surveillance and privacy concerns.[6]

In the private sector, the primary driver of blockchain smart contracts has been the financial services sector.

How governments and private banks manage their new CBDC consumer assets will be paramount. Digital wallets, hardware (i.e., Universal Serial Bus [USB]) wallets and other cryptocurrency-related products will soon become very important for traditional banks and other financial services providers. There are social benefits as well, such as reduced fraud and graft, less shadow or predatory banking, and more access to governmental benefits as CBDCs become widely implemented. In addition, automated teller machines (ATMs) and brick-and-mortar banks may become less useful to customers as CBDCs are available on smart devices and cash is slowly phased out. In the financial technology

(fintech) space, there has been a rise in the number of completely digital (and regulated) banks and financial services providers that operate without any physical entities or ATMs (e.g., Varo Bank, Chime).

Another area in which governments have used blockchain smart contracts is national identity management. For example, Estonia[7] and New Zealand[8] have used smart contracts to establish online government services using blockchain identity management software to provide remote digital services to their citizens. Since the onset of the COVID-19 pandemic, there has been research into the use of blockchain to mitigate coordination problems related to patient information, vaccine passports, contact tracing, financial funds disbursement, supply chain management, online education, contactless delivery, food distribution and egovernment. Interest in blockchain and smart contract technology has experienced a surge of interest within the governmental policy sector.[9, 10, 11]

New Legal Entities

Blockchain smart contracts can facilitate the creation and development of a new type of legal entity: the decentralized autonomous organization/decentralized autonomous corporation (DAO/DAC), which can self-organize and self-operate on a blockchain. Examples of DAO/DACs being recognized within the United States include the American CryptoFed DAO being legally recognized by the State of Wyoming as a first DAO. Additionally, Ohio and New Jersey currently have similar legal proposals at the state level. In the Southern District of California, there is a filing to classify a DOA as a type of general partnership. Recognized lawsuits, liability and capitalization in case of liability are commonly enforced as extensions of the limited liability company (LLC) legal structure and process with examples in multiple jurisdictions.

Governance rules, decision-making processes and even customer services can be managed as part of DAO/DAC blockchain smart contracts.[12] Investors in DAOs/DACs can participate in the decision-making process via decentralized voting or similar decentralized mechanisms, guaranteeing that the majority of participants agree to the outcome, which is unique to blockchain-based trust systems.[13, 14]

These new legal entities have the potential to replace traditional legal entities such as limited liability companies (LLCs), corporations and

nongovernmental organizations (NGOs). New laws are being passed to address the needs of DAOs/DACs in numerous US states and European nations. [15, 16, 17, 18] The creation of these entities is driving private-sector investment in blockchain smart contract research and adoption.

Figure 1 reflects the governmental hierarchy of digital assets, based on the traditional view that securities and enterprises are the primary units within the economic marketplace and, thus, any blockchain-based product, service or enterprise must fall within this traditional hierarchy.

Public and Private Sector Adoption

In the public sector, blockchain smart contracts are already affecting governmental registers of land ownership and public healthcare. In the private sector, the primary driver of blockchain smart contracts has been the financial services sector (**figure 2**), with other sectors such as peer-to-peer ride-sharing applications, self-issued bonds, crowdfunding campaigns and future dividends to investors also being affected.[19, 20, 21, 22, 23, 24] In the future, public-sector activities such as government administration services and voting systems are likely to be affected. Future private-sector activities such as cloud services and attestation services—all of which transform business operations and institutions—will also be affected.[25, 26]

Figure 2 shows the industries that are most advanced in the adoption of blockchain smart contracts.[27]

Smart Contract Interaction With Physical Assets

Smart contracts can interact with physical assets through Internet of Things (IoT) devices, enterprise resource planning (ERP) systems, bar codes and radio-frequency identification (RFID) tags connected to the physical items and linked to the digital smart contract.[28] Supply chain examples of smart contract adoption have occurred in transportation (e.g., trucking, shipping) to increase end-to-end visibility of the product life cycle. There is a ripple effect from the creation of trusted data based on the complete product life cycle that allows producers to offer unique, customized experiences that increase value for their customers by reducing fraud and product counterfeiting. In addition, smart contracts are used in hazardous waste material governance and guaranteed safe pharmaceuticals delivery. Agricultural uses include supply chain tracking of organic produce in the US State of California and produce traceability in rural India.[29, 30, 31]

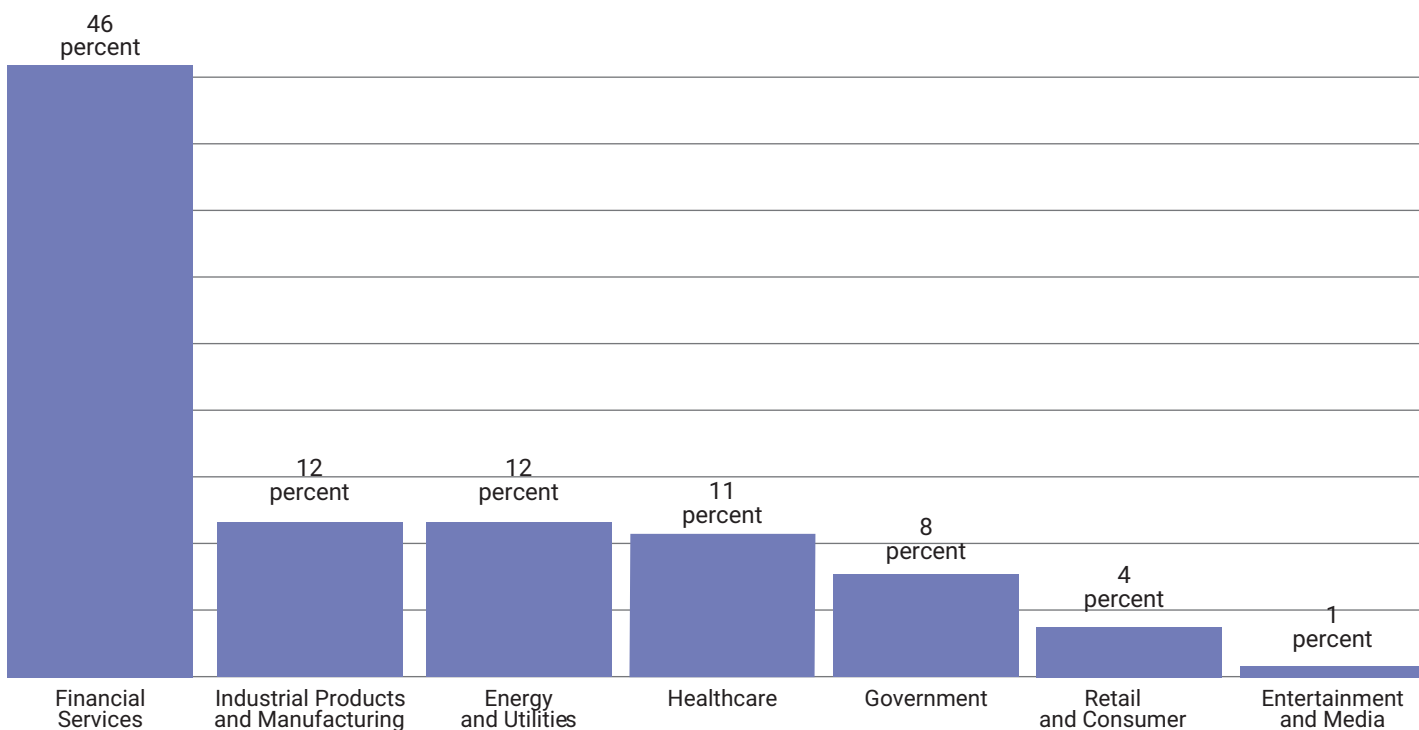## Accounting, Auditing and Internal Control Examples

Smart contracts and blockchain enable real-time accounting so that interested parties can instantaneously obtain accurate financial information for auditing or other purposes.[32, 33] Blockchain smart contracts allow auditors to automate the process of comparing accounting entries, permitting audits across all items in an audit population rather than only a selected sample.[34] In addition, because of their

FIGURE 1

Hierarchy of Blockchain-Related Enterprises

FIGURE 2

Blockchain Adoption Rates by Industry

Financial Services	46 percent
Industrial Products and Manufacturing	12 percent
Energy and Utilities	12 percent
Healthcare	11 percent
Government	8 percent
Retail and Consumer	4 percent
Entertainment and Media	1 percent

decentralized nature, blockchain smart contracts reduce the risk of a single point of failure or fraud during the audit process, making it more difficult for an individual to override the inputs of other users or override internal system controls.[35, 36]

> One of the major challenges to the adoption of blockchain smart contract technology is a lack of education and little understanding of how the technology can and should be utilized.

Within the Big Four global accounting firms, large enterprises and consortia of multiple interconnected enterprises, private and permissioned blockchains were the first to be adopted.[37, 38, 39, 40] Deloitte, PricewaterhouseCoopers (PwC) and Ernst & Young (EY) have all developed auditing tools specifically for blockchain smart contract transactions—for both private

permissioned and permissionless blockchains.[41] For example, since 2016, PwC has offered a suite of auditing tools for various cryptocurrencies and a related suite of tools for smart contracts.[42]

The Big Four global accounting firms are actively preparing to offer blockchain advisory and assurance services. Both PwC and Deloitte have argued that blockchain smart contract technology will improve collaboration and sustainability within the economy and will structurally alter business processes and practices among customers, sellers, competitors and suppliers.[43] However, one of the major challenges to the adoption of blockchain smart contract technology is a lack of education and little understanding of how the technology can and should be utilized.

Corporate Adoption and Cost Savings

Large enterprises were the first to invest in blockchain and smart contract training and infrastructure. By 2018, roughly 90 percent of all European and US banks had explored some form of blockchain technology, and 74 percent of Fortune 500 corporations' executive teams recognized the business potential in the adoption of blockchain technology. *Deloitte's 2021 Global Blockchain Survey*

reported that 24 percent of Fortune 500 corporations invested between US$5 million and US$10 million in blockchain technology in 2021.[44] The financial sector is the largest adopter, accounting for more than 60 percent of the world's market value in blockchain and smart contract technology. It is estimated that the infrastructure costs of banks and financial institutions can be reduced by up to 30 percent with the adoption of blockchain technologies. Actual cost savings from blockchain adoption are reportedly close to 27 percent.[45, 46, 47, 48]

Key Blockchain Smart Contract Projects, Organizations and Assistance for Early Adopters

Large enterprises that were early adopters and commercial supporters of blockchain smart contracts are commonly associated with at least one of the many parts of the Linux Foundation's Hyperledger project, called the Hyperledger Foundation.[49] Originally started in 2015, the Hyperledger Foundation is an umbrella organization comprised of a number of open-source software projects whose common goal is to create software tools catering to the blockchain ecosystem. There are more than 15 different subprojects that all fall under the Hyperledger name, including Hyperledger Fabric, Hyperledger Indy, Hyperledger Sawtooth, with constant new additions. Each subproject tackles a particular part of the open-source blockchain smart contract ecosystem. Hyperledger Fabric is the oldest subproject and has the most enterprise supporters. The Hyperledger Foundation has obtained large enterprise investments and support from organizations such as Intel, IBM and SAP. In addition to enterprise sponsorship and adoption of Hyperledger products, some of these same supporting enterprises have developed their own independent internal blockchain smart contract solutions, including JP Morgan Chase and Walmart.[50, 51, 52, 53]

If an enterprise already has a preexisting relationship with one or more of the large corporate supporters of the Hyperledger Foundation (i.e., IBM, Microsoft, Deloitte Touche Tohmatsu, Digital Asset Holdings, JP Morgan, Intel, SAP, Accenture), that enterprise may be in the best position to provide technical support and guidance in the implementation of a smart contract project to another enterprise. For other examples of how to implement one of the many

Any investment in blockchain smart contract technology should solve a well-defined business problem that will have a positive impact on both business operations and customer satisfaction.

Hyperledger projects and blockchain smart contracts, organizations can consult other early adopters such as Cisco, Commonwealth Bank of Australia, Goldman Sachs Group, Walmart, UBS Group AG, Credit Suisse Group.[54, 55, 56, 57]

Recommendations

For enterprises interested in what open-source blockchain smart contract implementations are available, it is recommended to start from a use case or problem/solution-based viewpoint. What problem will blockchain smart contracts solve for the organization? Is the organization looking to automate and better secure its digital and physical supply chain, join an open-source ecosystem that rewards and incentivizes customers, interact with public services, or help vulnerable populations? These are the types of questions any manager needs to ask when deciding on one of the multitudes of open-source software options for their business's blockchain smart contract needs. For example, IBM, Intel, Microsoft and other Fortune 500 firms often release a variety of open-source, free-to-use customizable software solution offerings, though users are essentially required to use and engage with the Hyperledger Foundation community and the associated cloud providers.[58]

Although being locked into a particular community and ecosystem may be problematic for some users, there are examples of Hyperledger adoption doing great things in many areas such as environmentally sustainable foods.[59] Other open-source projects, such as the Digital Asset Modeling Language (DAML) blockchain smart contract solution, are focused on serving the specific needs of the financial industry and institutions.[60, 61] Finally, legal considerations on the viability of any blockchain smart contract business strategy need to be taken into account given the recent SEC and EU regulatory attention in the tangential area of digital assets as securities.[62]

Managers should determine their needs and constraints before engaging with any of these open-source ecosystems. Any investment in blockchain smart contract technology should solve a well-defined business problem that will have a positive impact on both business operations and customer satisfaction. There are many potential pathways for adoption, and different domains will have distinct requirements, so it is crucial to understand business needs and commonalities across the various business units.

Conclusion

Blockchain smart contract technology is growing at an exponential rate, with numerous nascent projects associated with CBDCs and new types of legal entities. Although the financial services industry is the primary driver and beneficiary of this growth, virtually all other sectors of the economy and the government are likely to be affected. Blockchain smart contract technology is here to stay, and accounting and audit professionals must master the technology if they want to stay relevant. Understanding examples of blockchain smart contract technology helps accounting and IT management professionals get started on the path of adding it to their business processes.

Endnotes

1   US Securities and Exchange Commission (SEC), Prepared Remarks of Gary Gensler, Chair of the Securities and Exchange Commission, Before the American Bar Association Derivatives and Futures Law Committee Virtual Mid-Year Program, 21 July 2021, *https://www.sec.gov/news/speech/gensler-remarks-aba-derivatives-futures-law-committee-virtual-mid-year-program-072121*

2   Crain, B. F.; S. Couture; "Lukas Abegg; Smart Contracts and the Law," Epicenter Podcast, Episode 149, 19 September 2016, *https://epicenter.tv/episodes/149/*

3   Zaruba Smith, S.; A. Garcia; "Blockchain Smart Contracts, Part 1: Introduction for Accounting and Auditing Professionals," *ISACA® Journal*, vol. 4, 2022, *https://www.isaca.org/archives*

4   Hyperledger Foundation, "Use, Install, Build, and Deploy Solutions Using Hyperledger Technologies," *https://www.hyperledger.org/use*

5   Bank of International Settlements (BIS), C*entral Bank Digital Currencies: Foundational Principles and Core Features*, Switzerland, 2020, *https://www.bis.org/publ/othp33.pdf*

6   PricewaterhouseCoopers (PwC), *The Rise of Central Bank Digital Currencies (CBDCs)*, November 2019, *https://www.pwc.com/gx/en/financial-services/pdf/the-rise-of-central-bank-digital-currencies.pdf*

7   PricewaterhouseCoopers (PwC), *Estonia—The Digital Republic Secured by Blockchain*, 2019, *https://www.pwc.com/gx/en/services/legal/tech/assets/estonia-the-digital-republic-secured-by-blockchain.pdf*

8   Staff, "The Path to a Digital ID in New Zealand," *CIO*, 1 December 2018, *https://www.cio.com/article/204227/the-path-to-a-digital-id-in-new-zealand.html*

9   Kalla, A.; T. Hewa; R. A. Mishra; M. Ylianttila; M. Liyanage; "The Role of Blockchain to Fight Against COVID-19," *IEEE Engineering Management Review*, vol. 48, iss. 3, 2020, p. 85–96

10 Abd-alrazaq, A. A.; M. Alajlani; D. Alhuwail; *et al.*; "Blockchain Technologies to Mitigate COVID-19 Challenges: A Scoping Review," *Computer Methods and Programs in Biomedicine Update*, 2020, p. 100001

11 Ricci, L.; D. D. F. Maesa; A. Favenza; E. Ferro; "Blockchains for COVID-19 Contact Tracing and Vaccine Support: A Systematic Review," *IEEE Access*, vol. 9, 2021, p. 37936–37950

12 Dai, J.; "Three Essays on Audit Technology: Audit 4.0, Blockchain, and Audit App," Rutgers University, New Jersey, USA, October 2017, *https://rucore.libraries.rutgers.edu/rutgers-lib/55154/pdf/1/play*

13 Wright, A.; P. De Filippi; "Decentralized Blockchain Technology and the Rise of Lex Cryptographia," SSRN, 20 March 2015, *https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2580664*

14 Jarvenpaa, S.; R. Teigland; "Introduction to Trust, Identity, and Trusted Systems in Digital Environments Minitrack," Proceedings of the 50th Hawaii International Conference on System Sciences, USA, January 2017

15 Crain, B. F.; S. Couture; "Jerry Brito and Peter Van Valkenburgh: Coin Center—The Current US Regulatory Landscape for Crypto," Epicenter Podcast, Episode 417, 10 November 2021, *https://epicenter.tv/episodes/417/*

16 Crain, B. F.; S. Couture; "Nike Morgan; The DAO, the SEC and the ICO Boom," Epicenter Podcast, Episode 198, *https://epicenter.tv/episodes/198/*

17 *Op cit* Crain and Couture, 2016

18 Crain, B. F.; S. Couture; "Florian Glatz; Defining a Legal Framework for Decentralized Autonomous

Organizations (DAO)," Epicenter Podcast, Episode 125, *https://epicenter.tv/episodes/125/*

19 Shubber, K.; "Blockchain Initiative Pulls in Another 13 Banks," *Financial Times*, 29 September 2015, *https://www.ft.com/content/72ffd222-66be-11e5-97d0-1456a776a4f5*

20 Kokina, J.; R. Mancha; D. Pachamanova; "Blockchain: Emergent Industry Adoption and Implications for Accounting," *Journal of Emerging Technologies in Accounting*, vol. 14, iss. 2, 2017, p. 91–100, *https://doi.org/10.2308/jeta-51911*

21 Tapscott, D.; A. Tapscott; "How Blockchain Will Change Organizations," *MIT Sloan Management Review*, vol. 58, iss. 2, 2017, p. 10

22 Omatu, S.; *et al.; Distributed Computing and Artificial Intelligence, 13th International Conference*, Springer, Switzerland, 2016

23 Yuan, Y.; F. Y. Wang; "Towards Blockchain-Based Intelligent Transportation Systems," IEEE 19th International Conference on Intelligent Transportation Systems, November 2016

24 Dai, J.; M. A. Vasarhelyi; "Toward Blockchain-Based Accounting and Assurance," *Journal of Information Systems*, vol. 31, iss. 3, 2017, p. 5–21, *https://doi.org/10.2308/isys-51804*

25 Swan, M.; "Blockchain Temporality: Smart Contract Time Specifiability With Blocktime," *International Symposium on Rules and Rule Markup Languages for the Semantic Web*, Springer, Switzerland, 2016

26 *Op cit* Dai and Vasarhelyi

27 PricewaterhouseCoopers (PwC), *Time for Trust: The Trillion-Dollar Reason to Rethink Blockchain*, United Kingdom, 2020, *https://www.pwc.com/gx/en/industries/technology/blockchain/blockchain-in-business.html*

28 Sheldon, M. D.; "A Primer for Information Technology: General Control Considerations on a Private and Permissioned Blockchain Audit," *Current Issues in Auditing*, vol. 13, iss. 1, 2019, p. A15–A29, *https://doi.org/10.2308/ciia-52356*

29 van Hilten, M.; G. Ongena; P. Ravesteijn; "Blockchain for Organic Food Traceability: Case Studies on Drivers and Challenges," *Frontiers in Blockchain*, 30 September 2020, *https://www.frontiersin.org/articles/10.3389/fbloc.2020.567175/full*

30 Bettín Díaz, R.; A. E. Rojas; C. Mejía; "Blockchain for Colombian Organic Coffee Traceability on Hyperledger," February 2021

31 Patelli, N.; M. Mandrioli; "Blockchain Technology and Traceability in the Agrifood Industry,"

Journal of Food Science, vol. 85, iss. 11, 30 September 2020, pp. 3670–3678, *https://ift.onlinelibrary.wiley.com/doi/full/10.1111/1750-3841.15477#:~:text=(2019)%2C%20BCTs%20allow%20to,the%20transactions%20with%20individual%20producers.*

32 Yermack, D.; "Corporate Governance and Blockchains," *Review of Finance*, vol. 21, iss. 1, 2017, p. 7–31

33 *Op cit* Dai and Vasarhelyi

34 Fanning, K.; D. P. Centers; "Blockchain and Its Coming Impact on Financial Services," *Journal of Corporate Accounting and Finance*, vol. 27, iss. 5, 2016, p. 53–57

35 Peters, G. W.; E. Panayi; "Understanding Modern Banking Ledgers Through Blockchain Technologies: Future of Transaction Processing and Smart Contracts on the Internet of Money," SSRN, 18 November 2015, *https://papers.ssrn.com/sol3/papers/cfm?abstract_id=2692487*

36 Tasca, P.; T. Aste; L. Pelizzon; N. Perony; *Banking Beyond Banks and Money,* Springer, Switzerland, 2016

37 American Institute of CPAs (AICPA), Chartered Professional Accountants of Canada (CPA Canada), *Blockchain Technology and Its Potential Impact on the Audit and Assurance Profession, Deloitte Development, LLC*, 2017, *https://www.aicpa.org/content/dam/aicpa/interestareas/frc/assuranceadvisoryservices/downloadabledocuments/blockchain-technology-and-its-potential-impact-on-the-audit-and-assurance-profession.pdf*

38 Drescher, D.; *Blockchain Basics*, Apress, USA, 2017

39 Smith, S. S.; "Blockchain Augmented Audit: Benefits and Challenges for Accounting Professionals," *Journal of Theoretical Accounting Research*, vol. 14, iss. 1, 2018

40 *Op cit* Sheldon

41 Rozario, A. M.; C. Thomas; "Reengineering the Audit With Blockchain and Smart Contracts," *Journal of Emerging Technologies in Accounting*, vol. 16, iss. 1, 2019, p. 21–35, *https://doi.org/10.2308/jeta-52432*

42 Kate, P. T.; "PwC Launches Solution Supporting Audit of Cryptocurrency," PricewaterhouseCoopers, 2019, *https://www.pwc.com/th/en/press-room/press-release/2019/press-release-01-08-19-en.html#:~:text=Chanchai%20Chaiprasit%2C%20Assurance%20Leader%20and,holding%20or%20transacting%20in%20cryptocurrency.*

43 *Op cit* Dai and Vasarhelyi

44 Deloitte, *Deloitte's 2021 Global Blockchain Survey*, United Kingdom, 2021, *https://www2.deloitte. com/content/dam/insights/articles/US144337_ Blockchain-survey/DI_Blockchain-survey.pdf*

45 *Op cit* Kate

46 *Op cit* PricewaterhouseCoopers, *The Rise of Central Bank Digital Currencies (CBDCs)*, United Kingdom, 2019

47 *Op cit* PricewaterhouseCoopers, *Time for Trust: The Trillion-Dollar Reason to Rethink Blockchain*, United Kingdom, 2020

48 Mitic, I.; "Forty-Five Blockchain Statistics and Facts That Will Make You Think: The Dawn of Hypercapitalism," Fortunly, December 2021, *https://fortunly.com/statistics/blockchain-statistics/*

49 *Op cit* Hyperledger Foundation

50 Sahu, M.; "Top 15 Hyperledger Projects to Drive Blockchain Adoption (2022)," UpGrad, 6 January 2021, *https://www.upgrad.com/blog/hyperledger-projects-to-drive-blockchain-adoption/*

51 AllCode, "Hyperledger Fabric Software Development," *https://allcode.com/hyperledger-fabric/*

52 Androulaki, E.; A. Barger; V. Bortnikov; *et al.*; "Hyperledger Fabric: A Distributed Operating System for Permissioned Blockchains," Proceedings of the 13th EuroSys Conference, April 2018, p. 1–15

53 IBM, "What Is Hyperledger Fabric?" *https://www.ibm.com/topics/hyperledger*

54 *Op cit* Sahu

55 *Op cit* AllCode

56 *Op cit* Androulaki *et al.*

57 *Op cit* IBM

58 *Op cit* AllCode

59 *Op cit* Bettín Díaz *et al.*

60 Kfir, S.; C. Fournier; "DAML: The Contract Language of Distributed Ledgers," *Communications of the ACM*, vol. 62, iss. 9, 2019, p. 48–54

61 Digital Asset, *The Digital Asset Platform*, December 2016, *https://hub.digitalasset.com/hubfs/Documents/Digital%20Asset%20 Platform%20-%20Non-technical%20 White%20Paper.pdf*

62 Karasek-Wojciechowicz, I.; "Reconciliation of Anti-Money Laundering Instruments and European Data Protection Requirements in Permissionless Blockchain Spaces," *Journal of Cybersecurity*, vol. 7, iss. 1, 9 March 2021, *https://academic.oup.com/cybersecurity/ article/7/1/tyab004/6166133*