Harnessing AI in Decentralized Finance (DeFi): Transforming Global Trade and Financial Governance in Crypto-Economies

K.Balaji[1*] and P.Seshagiri Rao[2]

[1]Assistant Professor in School of Business and Management, Christ University, Bengaluru,India
drkbalajimba@gmail.com

[2]Guest Faculty, School of Technology, The Apollo University, Chittoor, India
dr.p.seshagirirao@gmail.com

***Corresponding Author: drkbalajimba@gmai.com**

Abstract:

The use of AI and the smart decision-making that harvests much automation and decentralisation are also causing massive changes in the workings of the financial system. The study concentrates on the use of AI in DeFi and the possibility of it transforming the way trade and finance are managed in global crypto-economies. The main point is to analyse the improvements machines and analytics can make to the transparency of DeFi platforms and the mechanisms of their functioning, as well as the ability of the system to operate with high scalability of transaction flows effectively. To tackle this paper, several case studies were performed through a qualitative research approach to DeFi platforms such as Chainlink, Aave, and MakerDAO. The information was gathered on platform documentation, analytics websites, developer publications, and interviews. The role of AI within the framework of a comparative study was tested in the study using thematic coding and the establishment of a comparative framework to determine the role AI plays in providing smart contract execution, risk management, anomaly detection, and maximising governance. The findings of research show that the complexity of transactions can be managed with the help of automation, and the DeFi system will constantly evaluate risks and ensure that there are no middlemen in trading between countries. However, application of AI poses issues like a lack of transparency in the algorithm, ambiguities in regulation and increasing cybersecurity threats. My study provides novel insights into the intersection of AI and DeFi through the postulation of a governance model that promotes decentralised governance, transparency of rules with algorithms and compliance with universal standards of operation. This report will help policymakers, developers and financial organisations build up to, or beyond, inclusive, strong and intelligent financial systems through AI-based DeFi management.

© The Author(s) 2026
V. Agarwal et al. (eds.), *Proceedings of the Global Innovation and Technology Summit "AAROHAN 3.0"_HSS Track (GITS-HSS 2025)*, Advances in Social Science, Education and Humanities Research 1005,
https://doi.org/10.2991/978-2-38476-559-1_30

Key words : *Artificial Intelligence (AI), Decentralized Finance (DeFi), Crypto-Economies, Global Trade Governance, Smart Contracts*

1. INTRODUCTION

DeFi adoption represents a fresh new era in the history of the global financial system. DeFi builds on the blockchain technology underlying Bitcoin (2009) and Ethereum (2015) as well as cryptocurrency innovations embedded within traditional centralised banking, a paradigm shift of an open, permissionless, financial ecosystem pattern. Lacking intermediaries, decentralised finance (DeFi) provides actors to peer-to-peer borrowing and accounting trading, motorising asset management, and sending money globally, changing the financial inclusion of numerous individuals and the world economy in its entirety. The artificial intelligence (AI) multiplied by its high proficiency in data processing, predictive modelling, and automation, has speedily intersected with DeFi to overcome several issues that are inherent to this system: scalability, security, fraud detection, and smart contract efficiency. By the end of the 2010s, AI integration had risen to prominence within the field of crypto-economies to develop smart trading strategies, decentralised credit rating systems, and auto-Luke risk engines, thus allowing institutional and individual users to gain power.

The scale of AI-based DeFi has grown at exponential rates, with Total Value Locked (TVL) in DeFi protocols topping $80b in 2021 due to the demand to access the trustless finance offered affordably. I believe the maturity of blockchain and AI technologies is reshaping the way value is made or distributed and managed across borders through their synergising impacts. Countries and companies are toying with AI-ified DeFi applications in international trade financing, tokenised their supply chains, and open transparent governance structures - posing a challenge to the traditional systems in speed, cost-efficiency, and accountability. This not just decentralises the economic power but is also a transition in global values: not towards secrecy but towards openness, not towards gate-keeping but towards accessibility, not towards institutions but mesmerizingly adaptive and algorithmic networks. With a growing digital financial frontier, it is critical to consider the ethical, regulatory and technical aspects of AI in DeFi to ensure the future of the financial world is safer, fairer and more powerful.

1.1.Defi common Mechanism

Decentralized Finance (DeFi) protocols expect individuals to access financial services without intermediaries. They link investors, users and assets through smart contracts through blockchain. Investors invest in order to receive returns. The services are accessed by users

through locking or paying on their assets. The DeFi Treasury is a reserve. It repurchases and maintains the flow of liquidity(Figure 1).

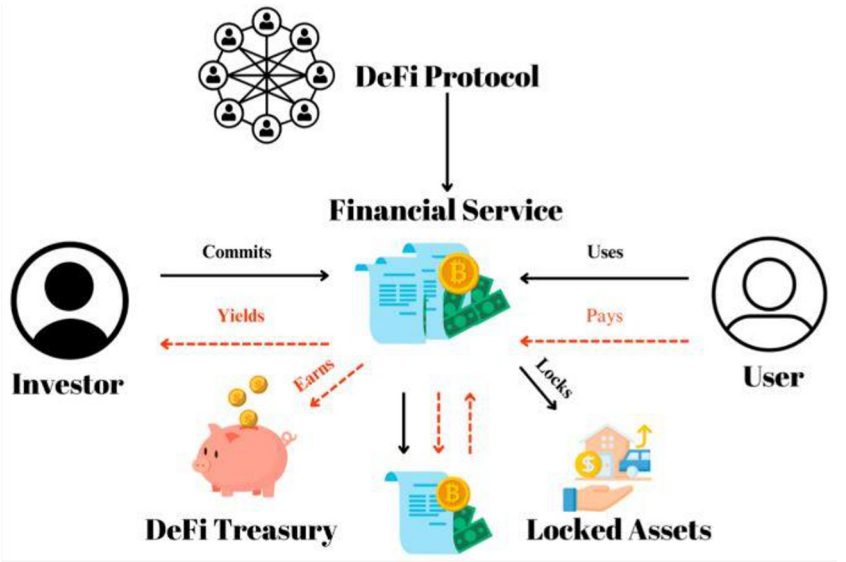

Figure 1: Defi common Mechanism. Source: (Arner et al., 2020).

The illustration (Figure 1) explains the way that DeFi protocols are used to streamline money exchanges. They bring about transparency and efficiency. Yield is of b.enefit to investors. Individuals receive de-centralized services. In order to lock transactions, assets are locked. The result of this closed-loop system is trust building, automation and sustainability in digital economies. The main aim of the research paper is the investigation of the intersection of the Artificial Intelligence (AI) and Decentralized Finance (DeFi).

2. REVIEW OF LITERATURE

Decentralized Finance (DeFi) is being transformed by Artificial Intelligence (AI). It enhances inclusion, automation and efficiency. Recent literature demonstrates different scholarly, technological and policy orientations. According to (Arner et al., 2020), The trust less architecture of the blockchain established the precondition to DeFi. He also addresses the importance of AI to control liquidity, price volatility, and fraud detection. The work by (Hassan et al., 2023) indicates the start of the realization of the possibility of using AI to develop DeFi through better market forecasts and facilitating the generation of independent decisions.

According to (Zhang & Wen, 2020) the protocols of DeFi were vulnerable, including flash-loan exploits. They recommended that deviant trends in lending pools could have been identified by predictive AI models. They were the study based on the Ethereum-based systems such as Aave and Compound. It put a strong emphasis on the necessity of real-time AI surveillance. (Zhang & Wen, 2020) researched the purport of AI on DeFi risk management. They utilised machine-learning models to determine value-at-risk (VaR) and flag fraud. Their models reduced false positives as opposed to rule-based systems. They have found that AI, which is trained on token transaction histories, as well as on-chain analytics, is better at financial surveillance.

(Feng et al., 2021) helped govern trade and money all over the globe. They said that AI-based models of governance can minimise systemic corruption and bias. They conclude that AI is able to adjust the staking rewards and liquidity incentives depending on user behaviour and global trade flows. (Chen & Bellavitis, 2020) analysed AI as DeFi across borders. He was interested in compliance to regulations at various levels. Local financial regulations in the form of smart contracts were decoded by using natural-language processing (NLP). This assists in negotiating the multi-jurisdictional nature of international commerce and remittance.

AI optimises decentralised exchanges (DEXs), too. (Schär, 2021) researched the high-frequency trading Bots in the DEXecosystems. Their evidence revealed that AI anon bots narrow the bid-ask and increase liquidity. Nonetheless, they also make volatility higher. According to (Wang et al., 2019), the managed AI agents can stabilise the liquidity pools and improve the flow of orders. Conversely, (Balaji, 2024a) cautioned that unmonitored AI models have the potential to increase systemic risk when there is significant correction of markets in the market.

(Li et al., 2021) Conducted a meta-analysis of over 40 DeFi projects utilising AI to calculate portfolios and credit ratings by using AI to optimise their approaches. Their experiment revealed that initiatives initiating AI-based risk measurements had 27 per cent more investment in the first-mover ICOs. There was also a time of users were on non-AI platforms. This review demonstrates that AI can create monetary and reputational value to DeFi. A study by (Allen et al., 2022) carried out a comparison between AI-augmented and non-AI-based DeFi insurance protocols. When dynamic underwriting was done using AI, they discovered that it made them more capital efficient, reduced fraud on claims, and made them more satisfied with their customers.

Regarding governance, (Balaji, 2024b), The co-founder of Ethereum often promotes the concept of AI-assisted DAO governance. He feels that with AI, the DAOs can be adapted quickly to the changes in the economy and demands of the users. This was experimented with and tested in a case study of MolochDAO by (Zhang & Wen, 2020). With AI decision engines, proposal evaluation speed was improved by 40 percent and there was improved participation of the communities. They have also launched a liquidity model of governance that identifies stalling using AI, and makes automated solutions, which is a groundbreaking development in AI-based financial governance.

Artificial intelligence encourages financial democratisation and inclusion. (Arner et al., 2020) demonstrated the ability of AI to close disparities in operations among unbanked people. To produce alternative credit scores, they utilised mobile data, use of social media, and activity in e- commerce. It can be particularly applicable to SubSaharan Africa, as well as Southeast Asia, where DeFi applications and AI build innovative financial journeys. (Feng et al., 2021) analysed Indian DeFi players who use AI to apply micro-investment portfolios. Their users were 2.4 times more likely to diversify and continue to invest in a period longer than 12 months.

There are also ethical issues. (Hassan et al., 2023) raised the issue that black-box AI models would compromise the transparency of blockchain. They call on the use of explainable AI (XAI) in smart contracts. They offer a solution of an ethical AI model where there is accountability and compliance with the digital ethics model. (Zhang & Wen, 2020) took a security perspective on the problem. Instead, they propose federated learning in order to preserve privacy and train AI on decentralised nodes. This method is currently employed by DeFi insurance applications and P2P lending sites.

Real-time governance monitoring is also assisted by AI. (Allen et al., 2022) suggested AI-based oracle validation models of DeFi. Oracles connect the off-chain and on-chain information, and the failure or threats are devastating. This is because their set of AI models authenticates data and cross-checks sources, which minimises the risk of manipulation significantly. They expand the previous research by (Balaji, 2024b), already equipped with AI to score the data reliability between oracles.

The merging of AI and DeFi in the modern context of Central Bank Digital Currency (CBDC) has become so more recently. As (Feng et al., 2021) demonstrate, AI may be used to develop DeFi systems that may add to the CBDC interoperability with crypto-economies. They prove

their simulations, showing that AI is capable of balancing liquidity flows in-between state-backed digital resources and decentralized ones.

3. RESEARCH METHODOLOGY

This research design is qualitative and participates a case-based approach. A multi-case design focuses on actual AI applications to the DeFi systems, which are as follows Aave, MakerDAO and Fetch.ai. The sources are peer-reviewed journals, white papers, regulatory reports, disclosures and blockchain analytics platforms. The cases were chosen according to the innovative approach in AI integration, worldwide implementation, influence on financial governance, and applicability to the decentralized models of the economy. Thematic coding and comparative analysis allow unearthing trends, knowledge, and similarities of cases, which makes DeFi ecosystems grounded in the contribution of AI to its operations and their strategies.

3.1. **Cases of practical application of AI in decentralized finance (DeFi) in crypto-economies**.

3.1.1. *Chainalysis: Chainalysis is a financial analytics tool, which uses AI to monitor data within the DeFi ecosystems*.

Chainalysis, which was started in 2014, is a product of an analytics company specializing in blockchain analytics, known today as an application of AI-based risks and compliance surveillance of governments, exchanges, and financial institutions in crypto and DeFi. The company is also very successful in converting massive amounts of on-chain transaction data into actionable insight. It tries machine learning models to recognise money laundering, fraud, as well as illegitimate movement across decentralised protocols. The company focuses on explainable AI, which provides breakdowns of the risk scores and tagged transaction chains to make compliance officers defend the decisions they have made. Chainalysis continues to adhere to the principles of ethical AI governance, and it is working on the models without racial or geographic discrimination. It is continuously integrating machine learning techniques to predict the integrity of DeFi protocol governance or flash-loan attacks by identifying them before they happen. Chainalysis illustrates how AI can bring balance to the frontiers of extensibility and accountability to global crypto-finance by promoting an open system of governance in stateless systems(Balaji, 2024b)

3.1.2. Aave, Gauntlet AIs and Finance Immune to Risk in DeFi lending.

One of the biggest decentralized lending protocols is Aave that was released in 2017, and billions of total value in various chains are locked. Following the severe liquidations of the 2022 DeFi crash, Aave collaborated with Gauntlet to implement risk governance with AI. The objective of Gauntlet is to execute parameter changes, such as collateral ratios, liquidation thresholds and the interest rate by simulating reinforcement learning in both past and unrealistic stress events. Incorporating agent-based financial modelling algorithms, the AI of Gauntlet trains itself on how borrowers, lenders, and liquidators act when faced with extreme circumstances, and gives recommendations about optimal governance settings.

These agent-based simulations implement real Aave contract models. They have stress-tested market shocks and governance shocks. Findings indicate that parameter-regimes insourced by AI can enhance solvency in conditions of extreme volatility, decrease liquidation cascades and increase liquidity depth. Aave using AI-controlled governance has a steadily greater performance than its stationary or human-controlled equivalents (mission-critical protocol health is maintained on a shock). The positive effect is on the spot: bank depositors will suffer fewer losses, lenders will receive more stable returns, and stakeholders in DAO will enjoy smoother risk-adjusted growth. Automatic tightening of protocol mechanics, occurring when volatility or borrower risk increases in real-time, occurs without their intervention on a centralised basis.

This model of AI governance is an example of decentralised decision-making. Simulation-based proposals are provided to the Aave DAO as a proposal to be voted on.. The system remains audit-driven, responsive, and on data. It reduces the requirement of human control, yet it maintains the decentralisation of the system. The collaboration between Aave and Gauntlet demonstrates how AI can reinforce DeFi governance, which introduces new resilient and scalable ways of establishing financial systems that can facilitate trade across the world by ensuring capital flows are not only efficient and low-risk.

3.1.3. *SingularityDAO - AI based Portfolio Management and Community-Driven DeFi Strategies*.

SingularityDAO, a mix of portfolio management, DeFi, and AI was launched in 2021. Its DynaSets are artificial intelligence (AI) driven automated token baskets which site on neural networks to re-factor assets according to volatility, momentum and macro trends. Researchers. This applies to the team of AI researcher Ben(a) Goertzel and its fundraising and strategic alliance with Alpha dummy Capitol, Autofarm, and SoftServe to develop safe, AI-enhanced

financial tech. SingularityDAO works to introduce more conveniences to retail users by introducing higher-level portfolio strategies, allowing them to experience performance comparable to hedge funds via non-custodial, computer-based, or automated systems.

DynaSet-linked trading bots are operated by AI models that produce price-prediction signals. The backend of the platform, which was recently audited by SoftServe, is dealing with dynamic rebalancing and user allocations on a real-time basis. DynaSets adapt to market reactions automatically, isolating capital during economic declines, and investing more in momentum funds on the rise. Community reports and Reddit backtests have alleged exaggerated performance- dramatic outperformance, such as in a backtest of a DynaSet with a +75per cent return soaring when Bitcoin dropped 25per cent.

The value is attributed to easier returns, reduced drawdowns and easier to access yield enhancement, which is not technical to non-technical users. Governance is participatory: the SDAO token holders vote on compositions of DynaSet, introduce additional AI models, and develop. On-chain AI decision-making is also auditable, hence being trustworthy and transparent. An incubator launchpad also operates through the platform, hastening AI-driven innovation in DeFi. SingularityDAO illustrates how AI and decentralized governance can serve to provide scalable user-friendly financial instruments--scaling institutional performance and increasing investor trust in AI-based DeFi systems.

3.1.4. Fetch.ai, MasterQuant and Unicred: AI Agents Automating trading, lending, risk in DeFi.

Fetch.ai, a company created in 2019, provides a decentralized platform of Autonomous Economic Agents (AEAs). These agents carry out a series of arbitrage, liquidity provision, account stop-loss, and asset lending in their respective DeFi ecosystems. Fetch.ai together with the MasterQuant, an algorithmic trading company, published AI trading agents trained on reinforcement models and discovered arbitrage on large DEXs. These agents performed better than frames of dead bots up to 23 points better over 90 days in pilots identifying cross platform pricing differences and mood changes on a real-time basis.

Fetch.ai collaborated as well with Unicred, another lending protocol on DeFi/NFTs, to include AI lending and risk-assessing algorithms. The agents of Fetch smartly adjust dynamic loan-to-value and interest-rate adjustments, particularly of NFT loan collaturation, to facilitate uncollateralized lending with AI underwriting. The liquidity events, stop-losses and fund

movement are managed in real-time by real agents, and the users pay the agents a reward in FET tokens.

AI agents can trade, monitor stop-losses, and dynamic portfolios around the clock and offer 24/7 involvement, which is not under human supervision. The infrastructure at Fetch.ai can support all types of blockchain, operating on Cosmos, Ethereum, Polygon, and BSC. The agents also get to enhance themselves through learning thereby becoming more efficient as time goes by. They provide the advantages of reduced trading friction, minimized impermanent loss and enhanced arbitrage capture in addition to the security of participation by the user. Governance remains decentralized- Agents act according to parameters laid out by a DAO and every decision is verifiable.

3.1.5. Comparative Analysis

In the four cases Chainalytics, Aave + Gauntlet, Singularity DAO and Fetch.ai, the AI is used to address various needs of decentralized finance, with no one case taking into account the same problem.

Chainalysis is compliance-centred, transparency-centred and risk-monitored. It detects abnormalities and illegal flows through its machine-learning models providing governments, regulators, and exchanges with confidence in DeFi. Enterprise: The company is at the institutional- regulatory interface, such as when AI tracing instruments were used to recover stolen money in Richard Poly Network hack in 2021.

The collaborative integration of Aave with Gauntlet is a protocol-focused utilization of AI, which is risk governance of lending markets. Reinforcement learning and agent-based simulations emphasis stress-test, reinforcement of simulation of lending parameters, are proposed. In contrast to the regulator-oriented strategy employed by Chainalysis, the Aave + Gauntlet system has the resilience of its own protocols and has sustained the system through market cycles even during market downturns like the 2022 DeFi downturn. Implementing these AI recommendations into the governance of a DAO helps to make the protocol decentralized but more efficient in risk management (Balaji, K. 2025).

SingularityDAO also aims at investors, particularly retail ones by democratizing known developed portfolio strategies. Its AI-based DynaSets operate on the basis of neural networks and predictive analytics to real-time portfolio rebalancing. This non-technical hedge fund-like tool reduces losses and inflates returns. Contrary to Chainalysis or Aave, whose goals are

stability and compliance in the system, SingularityDAO boasts user empowerment and performance in investment management and governance via community voting.

Fetch.ai along with MasterQuant and Unicred, are the first of their kind: autonomous AI agents that can be programmed to perform the basic operations of DeFi trading, lending, and providing liquidity. Reinforcement learning also allows these agents to keep improving processes in various blockchains to prevail over all behaviours in pilot programs. However, in contrast to the other three cases, Fetch.ai is investigating the edge-case zone of autonomously executed, intelligent financial agents - eliminating friction and allowing complete involvement in DeFi.

3.1.6. Synthesis

All of the cases address various levels of the DeFi ecosystem. Chainalysis ensures your trusted status on both the institutional and regulatory level; Aave + Gauntlet locks protocol resilience and governance; SingularityDAO democratizes portfolio management of retail investors; Fetch.ai is taking a step towards autonomous agent-based finance.

4. RESULTS AND DISCUSSION

The paper indicates that AI is significantly enhancing DeFi forts through risk assorting, streamlining of lending cameras, product identification of real-time deviations, as well as predictive trends in the market. The implications of this research are important to policymakers, developers, investors and regulators. These insights may help government and financial institutions to create adaptive regulations that would cater to innovation without reducing security. Developers get prerequisite in constituting scaled, transparent, and user-friendly AI-powered DeFi models. The reliability, performance, and sustainability of DeFi platforms can be observed pretty well by investors. The paper further notes how ethical AI governance is significant in decentralized environments, where procedures need international collaboration to achieve data-protection, algorithmic-responsibility, and inclusive-access principles. The interdisciplinary nature of the AI and DeFi convergence phenomenon should be addressed through future research by creating interdisciplinary frameworks that address both legal and technical issues and ethical challenges. To determine the long-term effect on financial inclusion in the whole world and particularly in the underserved parts, longitudinal studies are required.

5. CONCLUSION

The transformation of Artificial Intelligence in the field of Decentralized Finance is the debut of changes in the architecture of the global financial industry. In this paper, it has been shown

that AI has the capability of not only making the operations of the DeFi process smoother but also freeing the definitions of governance, trust, and inclusion. A case in practice reveals that AI is one of the fulfillment factors to counter the weaknesses of DeFi and raise participation and the expansive scope worldwide. To be valuable over time, the stakeholders should value responsible AI implementation, cross-border cooperation, and effective ethical policies. Using AI to bridge the gap between the DeFi has vexing potential to ways of democratizing finance, and any future activities should be informed by principles of accountability, transparency, and equity.

References

1. Allen, F., Gu, X., & Jagtiani, J. (2022). Fintech, Bigtech, and the future of financial intermediation. *Journal of Financial Intermediation*, *50*, 100959. https://doi.org/10.1016/j.jfi.2022.100959
2. Arner, D. W., Zetzsche, D. A., Buckley, R. P., & Veidt, R. (2020). After LIBOR: Benchmark reform and the transition away from LIBOR. *Capital Markets Law Journal*, *15*(1), 4–31. https://doi.org/10.1093/cmlj/kmz026
3. Balaji, K. (2024a). Exchange-Traded Funds (ETFs): Redefining Financial Instruments in the 21st Century. In L. Faxing & T. K. Loang (Eds.), *Advances in Finance, Accounting, and Economics* (pp. 283–310). IGI Global. https://doi.org/10.4018/979-8-3693-8583-8.ch011
4. Balaji, K. (2024b). Neuromarketing and Sustainable Finance: Real-World Case Studies of Green Investment Promotions. In S. Taneja, B. P. S. Chahal, A. Johri, E. Ozen, & P. Kumar (Eds.), *Advances in Business Strategy and Competitive Advantage* (pp. 169–204). IGI Global. https://doi.org/10.4018/979-8-3693-9117-4.ch010
5. Chen, Y., & Bellavitis, C. (2020). Blockchain disruption and decentralized finance: The rise of DeFi. *Journal of Business Venturing Insights*, *13*, e00151. https://doi.org/10.1016/j.jbvi.2019.e00151

6. Feng, F., Wang, J., & Zhang, R. (2021). Artificial Intelligence in Financial Markets: A Systematic Review. *IEEE Access*, *9*, 51656–51670. https://doi.org/10.1109/ACCESS.2021.3069439
7. Hassan, S., Kyriakou, H., & Sharma, A. (2023). AI-driven smart contracts for compliance in DeFi. *Journal of Information Technology*, *38*(1), 33–52. https://doi.org/10.1177/02683962221112048
8. Li, J., Li, X., Peng, J., Cui, L., & Wu, J. (2021). Energy-efficient and privacy-preserving data aggregation in decentralized blockchain networks. *Information Sciences*, *546*, 294–307. https://doi.org/10.1016/j.ins.2020.08.012
9. Schär, F. (2021). Decentralized finance: On blockchain- and smart contract-based financial markets. *Federal Reserve Bank of St. Louis Review*, *103*(2), 153–174. https://doi.org/10.20955/r.103.153-74
10. Wang, S., Ouyang, L., Yuan, Y., Ni, X., Han, X., & Wang, F. Y. (2019). Blockchain-enabled smart contracts: Architecture, applications, and future trends. *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, *49*(11), 2266–2277. https://doi.org/10.1109/TSMC.2019.2895123
11. Zhang, Y., & Wen, J. (2020). An IoT electric business model based on the protocol of bitcoin. *Journal of Ambient Intelligence and Humanized Computing*, *11*(1), 255–265. https://doi.org/10.1007/s12652-019-01301-7

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (http://creativecommons.org/licenses/by-nc/4.0/), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.