Choice Coin v2

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Authors[1]

Julie Oligbo | Samuel Tosin | David Kazeem | Brian Haney

Abstract

Choice Coin v2 a governance platform for DAOs offering software services for voting, compliance, and interchain interoperability. This White Paper provides an overview of the Choice Coin DAO, discusses the foundational structures for Choice Coin software, and introduces the elements of the Choice Coin governance platform. Building on the success of the Choice Coin v1 model, Choice Coin v2 will scale development to a wider audience.

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Introduction

This Paper describes the foundational architecture for Choice Coin v2. Choice Coin is a growing governance platform and the largest open source software project on the Algorand blockchain. The goal for the Choice Coin community is to support the Algorand community in growing an open, collaborative, and borderless blockchain. Thus, the Choice Coin network is intrinsically designed to draw new members and retain existing members on the Algorand network through an optimized participation structure.

Choice Coin v1 introduced Decentralized Decisions, a globally secure voting platform on the Algorand blockchain. Still, more remains to be accomplished in creating decentralized governance mechanisms. Indeed, more development is needed to continuing growing DAO participation on Algorand. Participation is critical for DAOs because participation drives use, decentralization, and regulatory compliance. Thus, there is a need for a platform that consistently and constantly rewards users for participation in governance processes.

The problem this paper seeks to address is how to create a streamlined and self-sustaining system for decentralized governance. The solution, Choice Coin v2, will build on Choice Coin's Decentralized Decisions software to provide an integrated and continuously live web application for DAO governance. The web application will allow users to make a proposal or participate in DAO voting globally and at any time.

The purpose for Choice Coin v2 is to build a governance platform for DAOs on the Algorand blockchain. Part I provides an overview of the Choice Coin DAO. Part II discusses the foundational structures for Choice Coin software. Part III introduces the elements of the Choice Coin governance platform.

I. Choice Coin DAO

The Choice Coin DAO is a global network of contributors and community members focused on building the world's best voting technology. Choice Coin v2 builds on the existing voting infrastructure built by the Choice Coin DAO as an open source collaboration with contributions from over 100 developers around the world. Leveraging the Algorand blockchain, Choice Coin is the first and largest operational DAO on Algorand.

A. Algorand Blockchain

Blockchains are decentralized databases maintained by global computer networks. The structure of most blockchain networks consists of several computers called nodes, which are connected via the Internet and record transactions on a public ledger.[2] In the words of scholar Primavera De Filippi, "blockchain technology constitutes a new infrastructure for the storage of data and the management of software applications, decreasing the need for centralized middlemen."[3] In short, an active and dynamic architecture, a blockchain is a distributed ledger which records transactions between parties across the Internet.

Algorand is a proof-of-consensus blockchain, which evolved to improve security and efficiency compared to existing proof-of-work blockchains like Ethereum and Bitcoin.[4] One problem with proof-of-work blockchains is they require large scale electricity computation to validate transactions across a network. As a result, many worry about the negative environmental impacts resulting from proof-of-work cryptocurrency mining.[5] Algorand solves this problem, requiring minimal computation to validate global transactions using zero-knowledge cryptographic proofs.[6] Algorand's proof-of-consensus blockchain is better than existing proof-of-work blockchains by an order-of-magnitude, as measured according to computing costs, energy expenses, and transparent price trajectories.

On Algorand, transactions are data structures encoding the transfer of value between participants in a system. A key innovation for the Algorand blockchain is that transaction fees are *de minimis*, < \$0.01 per transaction because Algorand uses a proof-of-consensus mechanism to validate blocks instead of a proof-of-work. The proof-of-consensus mechanism incorporates the timestamp signature used in proof-of-work blockchains,[7] but relies on zero-knowledge proofs

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[2] David Mills et al., Distributed Ledger Technology in Payments, Clearing, and Settlement 10, Fed. Reserve Bd. Fin. & Econ. Discussion Series, Working Paper No. 95 (2016).

[3] PRIMAVERA DE FILIPPI, AARON WRIGHT, BLOCKCHAIN AND THE LAW 33 (2018).

[4] Yossi Gilad, et al., Algorand: Scaling Byzantine Agreements for Cryptocurrencies, 53 (2017).

[5] Liana Badea, The Environmental and Economic Impact of Bitcoin (March 2021), DOI:10.1109/ACCESS.2021.3068636. *See also* Lucas Girard, Environmental Impacts of Cryptocurrency Mining (2018). *See also* Heidi Samford. Lovely-Frances Domingo, The Political Geography and Environmental Impacts of Cryptocurrency Mining (July 10, 2019).

[6] Jing Chen, Silvio Micali, Algorand 4 (2017), arXiv:1607.01341. ("The amount of computation required is minimal.")

[7] Scott J. Shackelford, Steve Myers, Block-by-Block: Leveraging the Power of Blockchain Technology to Build Trust and Promote Cyber Peace, 19 Yale J. L. & Tech. 334, 351 (2017).

instead of hashing to validate transaction. The Decentralized Decisions software incorporates and builds on the existing consensus architecture within the existing Algorand software structure.[8]

B. Autonomy

Autonomy refers to machines which may operate without human intervention or command to achieve goals. In other words, autonomy is a process by which tasks or behaviors are mechanized. Within the decentralized autonomous organization (DAO) infrastructure autonomy is a term of degree. Throughout the evolution of the DAO, the general goal is to increase the decentralization and autonomy of the network.

Thus, autonomy is an iterative process focused on building software which becomes more automatic over time. In the beginning stages, autonomy usually develops in piecemeal fashion, requiring considerable work from humans in the loop. As the software progresses, the aim is for the software to be completely self-sustaining without the need for human intervention for proper execution.

In the context of DAOs, smart contracts are the keystone to autonomy because smart contracts are the main method of decentralized transactions on the blockchain. A smart contract is a computer program which transfers value or data on the blockchain.[9] Computationally, smart contracts are programs that are logically executed on a blockchain without a central oversight.[10] There are smart contracts which operate with more human intervention than others and overtime, the goal for DAOs is to design fully autonomous smart contracts that allow organizations to be governed purely by code.

The confluence of smart contracts and artificial intelligence technologies are driving the edge in decentralization technologies for the Choice Coin DAO.[11] The Choice Coin v2 software improves the autonomy within the v1 software in two main ways. First, the v2 software includes Tita – an automatic payments gateway allowing Algorand projects or Choice Coin DAO members to effectively launch a vote for governance, without having to manually submit an application. Second, the method by which the votes are reviewed and processed is made more streamlined in the v2, allowing for a crisp method of proposal processing.

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[8] Yossi Gilad, et al., Algorand: Scaling Byzantine Agreements for Cryptocurrencies (2017).

[9] Fabrice Benhamouda, et al., Supporting Private Data on Hyperledger Fabric with Secure Multiparty Computation, IBM Journal of Research and Development (April 2019), DOI: 10.1147/JRD.2019.2913621. ("Nearly all blockchain architectures support the notion of smart contracts, namely a programmable application logic that is invoked for every transaction.")

[10] Massimo Bartoletti, A formal model of Algorand smart contracts, 1 (2021), https://arxiv.org/abs/2009.12140v3. ("Smart contracts are agreements between two or more parties that are automatically enforced without trusted intermediaries.")

[11] Archie Chaudhury and Brian Haney, Smart Contracts on Algorand, SSRN 3887719 (2021). *See also* Irene Ng (Huang Ying), The Art of Contract Drafting in the Age of Artificial Intelligence: A Comparative Study Based on US, UK and Austrian Law, Stanford Law School, TTLF Working Papers No. 26, Stanford-Vienna Transatlantic Technology Law Forum (2017).

C. Voting

An ancient tradition in human history,[12] voting is a process by which collective decisions are made. Collective decision making is an important and essential part of groups across the world. Governments, corporations, charities, and many other organizations use voting as a means for making decisions. Indeed, voting happens around the world in corporate shareholder meetings, political elections, and everyday life.

Voting is important because it is a key method by which collective information is processed to determine consensus among groups.[13] In fact, voting is paramount because the right to vote is the central tenant of modern democracy, but also it is a principle means for capital allocation across both public and private economic systems. For many, voting is a central feature for a free society because it implies a rule governed by the people. As such, it is commonly said that the right to vote is something worth the ultimate sacrifice.

But modern voting systems formed by centralized entities and institutions have failed. More and more, populations are recognizing modern voting processes do not serve the public good. For example, political elections are full of fraud made easy by fractionalized polling. And Corporate boards are biased against the best interests of shareholders for votes of corporate governance matters. In fact, voting systems continue to depend on a centralized player with control over individual voting records and private information. As such, new forms of voting and democracy are needed which provide scalable, secure, and transparent mechanisms for voting.

Now decentralized voting is a key to DAO infrastructure in the growing decentralized internet. Building the great governance technology is the central focus for the Choice Coin DAO[14] and the purpose for Choice Coin v2 is capturing the throne. The Choice Coin v2 software draws inspiration from the simplicity of the first voting machine, which was invented by Thomas Edison, "...to produce an apparatus which records and registers in an instant, and with great accuracy, the votes of legislative bodies...", in the year 1869.[15]

While Edison's design was limited to votes of legislative bodies, Choice Coin v2 focuses on the votes of DAOs which allows the technology to generate a more secure, scalable, and systematic machine. The Choice Coin DAO now holds global votes with instantaneous results, leveraging the Algorand blockchain for security and scalability. In the next development phase, Choice Coin v2 allows any DAO to make a proposal to generate a vote on the Algorand blockchain.

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[12] Daniela Louise Cammack, Rethinking Athenian Democracy. Doctoral dissertation, 13-14 Harvard University. (2013), http://nrs.harvard.edu/urn-3:HUL.InstRepos:10423842.
[13] A consensus is a defined majority or agreement.
[14] Choice Coin White Paper, GitHub (2021), https://github.com/ChoiceCoin/White_Paper.
[15] U.S. Patent No. 90,646 to Edison, Electric Vote-Recorder (June 1, 1869).

II. Infrastructure

A common argument against digital assets and blockchains more generally is that the value isn't backed by anything. This argument is patently false because a global infrastructure of hardware, software, and human capital back the value of blockchains. Without infrastructure blockchains would not be able to operate or provide a mechanism for global and instantaneous payments. Part II provides an overview for the infrastructure supporting the Choice Coin v2 software stack.

A. Open Source Software

Open Source Software (OSS) is a keystone to Choice Coin's ability to be able to innovate and invent new technologies. The Choice Coin OSS program includes over 20 repositories with contributions from over 100 developers around the world. A key utility for the Choice Coin asset, Choice, is a reward token for developers. In this way, Choice Coin is able to sponsor hackathons, bashes, and micro-grants to grow both Choice Coin and the Algorand network.

Choice is an advantage for the Choice Coin DAO compared to other OSS projects, such as TensorFlow or OpenAI, which are institutional OSS projects run by Google and Microsoft respectively. Neither TensorFlow nor OpenAI compensate OSS developers for their contributions and use OSS contributions to drive profit. Choice Coin solves this problem by incentivizing developers with Choice, rewarding developers for their time, contributions, and efforts. This helps to correct the common economic and opportunistic inequality in institutional technology development.

The Choice Coin GitHub is the home of the largest open source project on the Algorand blockchain. Figure 1 provides OSS development information from the Choice Coin GitHub.

Repository	Contributors	Forks	License
Voting	78	1,600	Apache
NFTs	22	41	Apache
TEAL	21	24	Apache
Algorand-Protocol	19	20	Apache
HerTechChoice	10	12	Apache
Voting_DApp	9	11	Apache
ChoiceCoin.github.io	8	2,990	Apache
Smart_Contracts	7	464	Apache
DeFi	7	9	Apache
Machine-Learning	6	7	Apache
CHOICE_TinyMan_Wrapper	5	9	MIT
Choice-V1	3	243	Apache
Choice-Charities	2	1	Apache
Compliance	2	1	Apache
DeCHO	2	1	Apache
ASAlytics	2	4	MIT
Converter	1	1	Apache

Figure 1[16]

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[16] Data recorded on April 25, 2022.

The reason blockchains are designed to be open source is because the technology is intended to decentralize economic transactions through peer-to-peer networks.[17] For example, the Algorand GitHub repository for PyTeal, is publicly available under the MIT License.[18]

B. Research and Development

The Choice Coin DAO is a leading R&D platform on the Algorand blockchain. The Choice Coin DAO has over 100 contributors on GitHub and over 33,000 users on AlgoExplorer. The Choice Coin software is open source and available through the Apache License and the MIT License. Specifically, the Choice Coin v2 stack will be available under the Apache License, which permits public use and revokes liability.

The Choice Coin DAO is responsible for publishing eight open access scholarly papers on topics relating to Algorand, DAO infrastructure, and governance.

1. Decentralized Decisions on Algorand with Choice Coin, SSRN Paper No. 3,913,316 (2021).
2. Smart Contracts on Algorand, SSRN Paper No. 3,887,719 (2021).
3. Algomy: Predicting Algo Price, SSRN Paper No. 3,939,208 (2021).
4. Algorand Autonomous, MIT Bitcoin Expo Hackathon, SSRN Paper No. 3819055 (2021).
5. Cryptosecurity: An Analysis of Cryptocurrency Security and Securities, SSRN Paper No. 3880112 (2021).
6. Choice Coin White Paper, GitHub (2021).
7. Quantum Voting in Reach for Ethereum and Algorand 2, SSRN Paper No. 3860914 (2021).
8. Choice Algonomics, SSRN Paper No. 4,048,517 (2022).

In the year 2021, four patent applications were filed for technologies invented by the Choice Coin DAO.

Patent Application No.	Title	Date
17,375,542	Algogeneous smart contracts	July 14, 2021
17,410,676	Decentralized voting using quantum intelligence	August 24, 2021
17,483,297	Deep intelligence for decentralized finance	September 23, 2021
17,559,519	Voting using Choice Coin on a Blockchain	December 22, 2021

Figure 2

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[17] Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System 1 (2008).
[18] The MIT License, Open Source Initiative (2021).

Figure X is a list of patent applications filed for technologies invented for the Choice Coin DAO. The patent applications protect various inventions for DAO infrastructure including applications for smart contracts, voting, and decentralized finance. A keystone to the Choice Coin DAO's success is the most robust intellectual property portfolio on the Algorand blockchain.

C. Decentralized Decisions

Decentralized Decisions is a full stack software for decentralized voting using a quantum secure protocol and core software for Choice Coin v1. The smart contract infrastructure that constitutes most DVApps often relies on complex algorithms for simple functions. Many of these programs often have vulnerabilities that may be exploited by attackers. The overarching applications constructed from these smart contacts also includes multiple barriers to entry for the general population. Decentralized Decisions set out to solve these problems, making decentralized and direct democracy a reality.

To have widespread impact, blockchain applications must become simpler while retaining safety and efficiency. This evolution requires fundamental changes in how the smart contracts that drive these applications are built. To meet this need, Decentralized Decisions software uses Algogeneous smart contracts.[19] The Algogeneous architecture allows for a secure software system to scale decentralized voting systems across blockchain networks by integrating both stateful and stateless functionality.

The Choice Coin v1 model was widely successful using Decentralized Decisions. In total, the model hosted six total votes – four of which were for Choice Coin DAO governance, one for AlgoCharts governance, and one for Yieldly governance. Thus, the software was successfully deployed for both internal and external governance operations. However, there was certainly room for improvement in the software. For example, one issue with the architecture is that it was severed for hosting purposes on two separate platforms, Heroku and Netifly.

Choice Coin v2 will solve problems existing in the Decentralized Decisions software by consolidating and simplifying architectures and code. For example, the entirety of Choice Coin v2 will be hosted on Heroku. Once the architecture and code base are simplified, the v2 model will be scaled to allow for multiple votes to run at once on the web application. In turn, this will allow for more volume to flow through the software for both Choice Coin DAO votes and external votes as well.

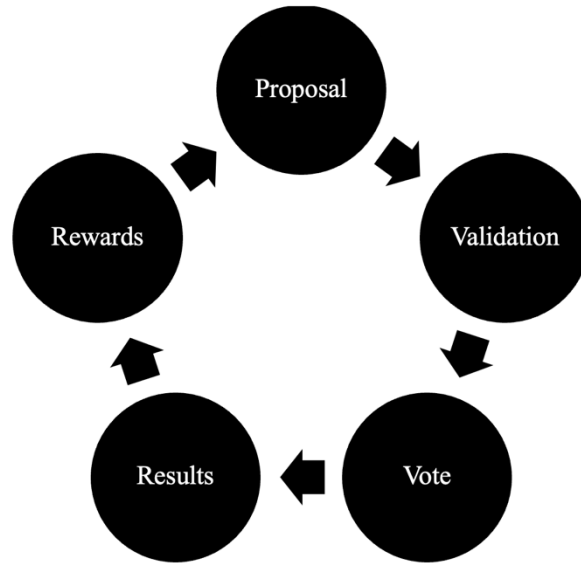[19] Archie Chaudhury and Brian Haney, Smart Contracts on Algorand, SSRN 3887719 (2021).

Figure 3

Figure 3 is a flow diagram for the autonomous structure for Choice Coin v2. Indeed, increasing autonomy and decentralization will also be important in the v2 architecture. In Choice Coin v1, the smart contract model deployed required manual intervention for ending votes and returning rewards. However, Choice Coin v2 will automate these processes with new smart contracts to allow for a greater degree of decentralization. Still, the central Decentralized Decisions structure will continue to support globally secure votes with instant results on the Algorand blockchain.

III. Governance Platform

The overarching goal for Choice Coin v2 is advance toward a comprehensive decentralized governance platform. Governance is a process by which decisions are made and assets are allocated among organizations.
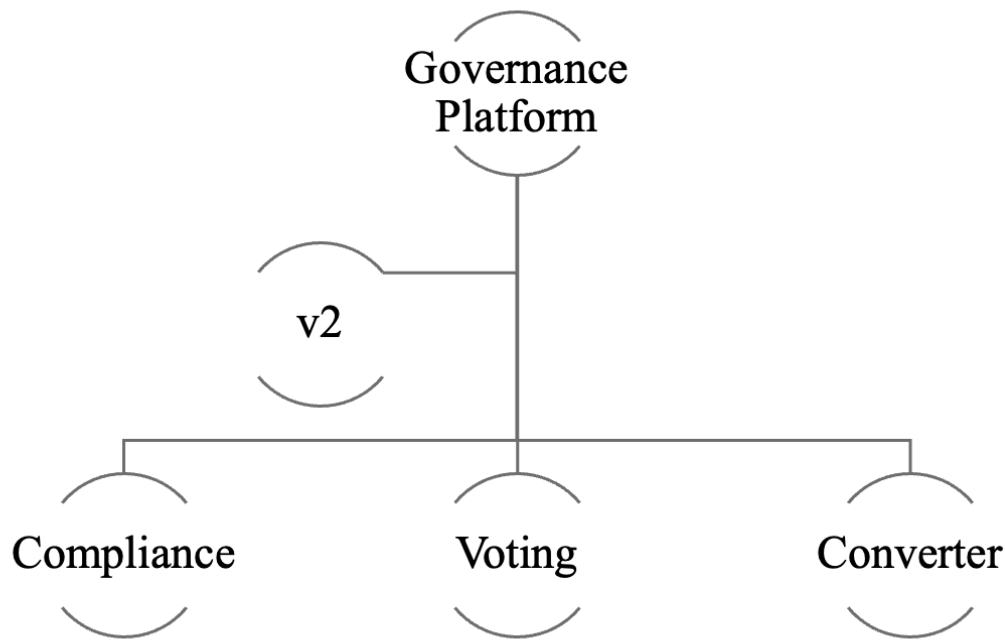

Figure 4

Figure 4 illustrates the v2 improvements and model for DAO services offerings on the Choice Coin Governance Platform. Each of the three services offerings have been developed for internal use by the Choice Coin DAO. However, the underlying technologies are in demand for DAOs more generally.

Indeed, the Choice Coin compliance software and voting software have already built a strong foundation for use with partners including the Algorand Foundation, the Solana Foundation, Yieldly, and AlgoStake. In addition to the need for rewarding participation and adding a voting mechanism, Choice Coin governance also aids project by providing visibility. With the growing popularity of DAOs, Choice Coin v2 seeks to meet an expanding demand in the market for governance services. The governance platform has three components: processing proposals through votes, compliance automation, and interoperability via a heterogeneous blockchain converter.

A. Proposal Processing

Proposal processing refers to the various methods needed to allow decentralized voting to flow. To help automate proposal generation, the Choice Coin DAO developed a new governance

gateway called Tita. Tita is the Choice Coin payment gateway for ASA Governance, allowing anyone to make a proposal for a new vote, pay a software as a service fee, and provide rewards for voters. To promote inclusiveness and enable fresh ideas to be raised among users, Tita enables anyone to raise governance issues and deliberate.

Proposals are backbone for decentralized governance. Without a distributed process by which organizations can improve, DAOs become centralized, stagnant, and unstable. DAO participants need a mechanism by which they govern rules, software development, and growth strategy. In fact, Choice Coin v1 was able to meet this demand for two Partners in addition to the Choice Coin DAO itself, Yieldly and AlgoCharts.

In Choice Coin v2, proposals are processed originally through Tita, the governance gateway. Upon submission via Tita, the developer team screens proposals and approves them for vote. The approval process balances the need for decentralization and quality control – which is necessary to avoid vulgarity, criminal activity, or otherwise inappropriate proposals. After being approved, votes made available to public on Decentralized Decisions for a public vote.

B. Compliance Automation

The most significant piece of compliance literature to date,[20] *The Compliance Process* distills the corporate compliance function to foundational formalism.[21] Professor Veronica Root Martinez reasons from fundamental principles about the role compliance plays within the firm to create a formative model for organizational excellence. In fact, Professor Martinez invented a new method for evaluating compliance failures by categorizing the compliance function to identify and isolate the stage at which the misconduct occurs.[22]

Professor Martinez, "applies findings from organizational behavior and corporate governance regarding the power of process reforms to the efforts of complex organizations to adopt global compliance programs."[23] In doing so, she "demonstrates how focusing on process reforms will allow complex organizations to adopt more integrated and complex compliance programs that are better equipped to address corporate misconduct."[24] As such, Professor Martinez encourages firms to engage in a more specific discussion about compliance,[25] with particular reference to *The Compliance Process*.

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[20] The formalism introduced in the following Article makes the most significant contribution to the compliance literature ever. Indeed, compliance is a relatively new field in its own and the formalism introduced provides a foundational architecture to the fields advancement.

[21] Veronica Root, *The Compliance Process*, 94 IND. L.J. 203 (2019), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3151893.

[22] *Id*. at 219.

[23] Veronica Root Martinez, *Complex Compliance Investigations*, 120 COLUMBIA L. R. 249, 307 (2020), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3350463.

[24] *Id*.

[25] Veronica Root Martinez, *The Monitor- 'Client' Relationship*, 100 VA. L.R. 532 (2013), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2309498. (Discussing the specific compliance circumstances in which firms failing in compliance will likely find themselves.) *See also* Veronica Root Martinez, *Modern-Day Monitorships*, 33 YALE J. REG. 1505 (2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2581700.

Compliance and ethics are important for blockchain startups and projects. As part of its governance platform, Choice Coin is inventing a new methodology for certifying the legitimacy of projects on Algorand. Through Choice Coin's compliance as a service offering, Choice Coin provides a compliance analysis for projects, which can be used to aid projects with exchange listings, user relations, and business partnerships. Indeed, every blockchain project needs to be able to certify their compliance with applicable laws and regulations – and Choice Coin v2 will help to meet the demand for compliance as a service.

Choice Coin is automating compliance for blockchain technologies using an algorithm for optimality.[26] This allows for direct performance measurement according to defined, clear, and objective features. Choice Coin is utilizing legal informatics to optimize its compliance protocols and offering compliance as a service as part of its governance platform.

By optimizing compliance according to a regulatory corpus aggregated in an open source database,[27] Choice Coin compliance is able to minimize regulatory risk through automated analysis and policy development. In addition to a growing customer base, the compliance automation offering, the Choice Coin DAO has won a grant award from the Solana Foundation to advance compliance software, research, and writing. As a result, the possibilities for interchain development are expanding in the greater market.

C. Interoperability

Interoperability is a process by which blockchains connect. As the decentralized landscape grows, so too do the blockchains existing the space. In addition to Algorand, Bitcoin, and Ethereum, there are many more blockchains – such as Cardano, Solana, and Avalanche. To facilitate interoperability for the Choice Coin DAO, open source software programs are dedicated to building converter technology. A converter is a method for moving assets between blockchains. Unlike a bridge, the Choice Coin converters are focused on using state-proof-technology to facilitate lower-cost transactions and on-chain results.

Choice Coin DAO Vote 2 determined the first blockchain with which Choice Coin will build a converter is Ethereum, which won over Solana. Over time, the Choice Coin DAO hopes to build interoperable systems with both blockchains.

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[26] Brian Haney, Tulane Journal of Technology & Intellectual Property, Vol. 24, (2021).
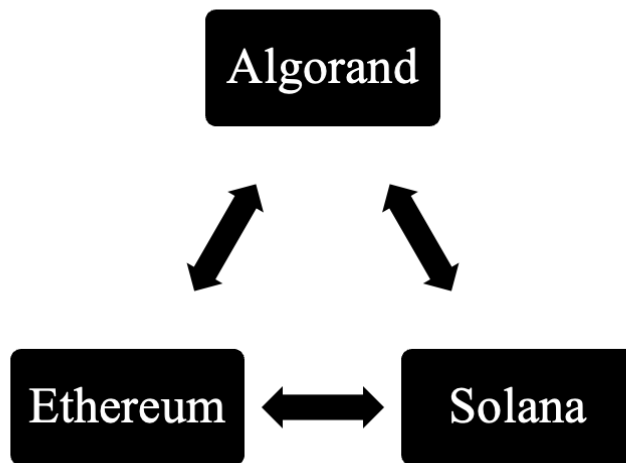[27] Choice Coin GitHub, Compliance (2022), https://github.com/ChoiceCoin/Compliance.

Figure 5

Becoming a multi-chain DAO will allow Choice Coin to de-risk the Choice asset's performance, to open new streams opportunity for grant awards, and to allocate resources in places that will most effectively capture value.

Our solution to the blockchain interoperability problem is the Converter, an open source tooling suite of smart contracts allowing for on-chain transactions between blockchains using state proofs. Converters will allow for value transfer from other blockchains to the Algorand network where Algorand will act as a nucleus for the software architecture. The key features of the technology will be a simple and easy to use smart contract suite, which will allow developers to build interoperable systems between Algorand and other blockchains.

Various strategies may be deployed to build the converter including blockchain oracles such as Chainlink,[28] smart contracts, and state-proofs[29] to validate transactions between blockchains. The Choice Converter application is an application demonstrating the success of the underlying tooling suite by enabling asset conversions and multi-chain creation for ASAs. In turn, this will help to boost the credibility of and recognition for assets created on the Algorand blockchain. In addition, the Converter will create more opportunity for interchain collaboration and value creation.

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[28] Lorenz Breidenbach, et al., Chainlink 2.0 and the future of Decentralized Oracle Networks (2021).
[29] Silvio Micali, et al., Compact Certificates of Collective Knowledge (2021).

Conclusion

Choice Coin v2 is a next generation interchain governance platform for DAOs. Part I offered an overview of the Choice Coin DAO. Part II provided the foundational structures for Choice Coin software. Part III discussed the elements of the Choice Coin governance platform in detail.