

Innovest: A ML-enabled and Blockchain-based DAO providing Venture Capital services

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Abstract —

In this decentralized setup, a diverse community of investors from around the world collaboratively contribute resources and expertise, collectively steering the investment process.

Smart contracts facilitate consensus-based decision-making, promoting fairness and efficiency. Eliminating intermediaries fosters a trustless environment, inspiring confidence and attracting a broader spectrum of investors. The decentralized DAO model offers entrepreneurs access to a global network of backers with varied expertise and industry connections. Projects are scrutinized right from the first step and funding decisions are based on the merit and potential of projects.

Security and transparency are paramount in DAOs, blockchain technology ensures immutable and auditable records of all transactions, minimizing fraud and enhancing trust among participants. The decentralized DAO for venture capital presents a unique opportunity for established firms to evolve and embrace a more inclusive and collaborative approach. As the industry pioneers this paradigm shift, there is an opportunity to shape a resilient and adaptive ecosystem that nurtures groundbreaking ideas and drives positive change.

In conclusion, the abstract sheds light on the transformative potential of decentralized DAOs for venture capital firms. As the world embraces this novel approach, the future of investment practices will be defined by transparency, decentralization, and a global community united in their pursuit of innovation and entrepreneurial success.

I. INTRODUCTION

Traditionally, venture capital firms have played a crucial role in fuelling the growth of innovative startups by providing funding, mentorship, and valuable industry connections. However, the traditional model often faces challenges such as geographical limitations, centralized decision-making, and barriers to entry for aspiring investors.

The emergence of blockchain technology and the concept of DAOs presents an exciting opportunity to address

these challenges and unlock the untapped potential of the global investment community. A DAO is an organization governed by smart contracts on a blockchain, allowing for decentralized decision-making, transparency, and community-driven governance. In the context of venture capital, a decentralized DAO for a venture capital firm empowers a diverse and distributed group of investors from around the world to participate in funding promising startups. These investors pool their resources and expertise to make investment decisions through a transparent and consensus-based process collectively.

By eliminating intermediaries and introducing a trustless environment, our DAOs will be handling the investments done by the investors and providing capital to early-stage startups so that they can grow and create more value.

II. RELATED WORK

Reference [1] emphasizes how DAOs address shortcomings in the venture capital market, particularly focusing on the role of reputation as capital within these decentralized structures. It also talks about how VCs increasingly focus on funding later-stage companies. Reference [2] assesses the performance of machine learning algorithms for decision support in venture capital investments, highlighting the potential of machine learning in enhancing due diligence processes. Building upon this, our project aims to streamline the venture capital funding process by leveraging machine learning algorithms to automate due diligence and provide a rating system for startups pitching over the platform. [3] provide an understanding of DAOs from an internal perspective, focusing on their organizational structure and governance mechanisms. This insight will inform the design and governance mechanisms of our venture capital DAO, and enhance transparency and efficiency in decision-making processes.

Looking at reference [4] discusses the design of blockchain-based DAOs, emphasizing technical considerations and architectural aspects. Drawing insights from this, our project will inform the technical implementation of our venture capital DAO on the Ethereum

blockchain, ensuring scalability and security in investment processes. Reference [5] presents an overview of blockchain-based DAOs, discussing their societal implications. This perspective will help us consider the broader implications of our venture capital DAO within the Ethereum ecosystem, particularly in terms of fostering decentralization and democratization of venture capital funding.

[6] conduct a comparative analysis of platforms for DAOs on the Ethereum blockchain, focusing on their features and functionalities. Insights from this analysis will inform the design and functionalities of our venture capital DAO, ensuring usability and accessibility for investors and entrepreneurs. [7] propose an integrative model and research agenda for DAOs, emphasizing their emergence and potential impact. This will help inform the strategic direction and future research agenda for our venture capital DAO, aligning with broader trends and advancements in the field of decentralized finance.

The subsequent section underscores the imperative for an innovative venture capital DAO, integrating machine learning algorithms and a user-friendly dashboard, to revolutionize the efficiency and transparency of venture capital investments. This strategic approach, informed by insights from existing research on DAOs and machine learning applications in venture capital, aims to streamline funding processes, enhance decision-making, and provide real-time portfolio visualization for investors and entrepreneurs.

III. NOVELTY OF WORK

Our project marks a groundbreaking initiative in investment platforms, focused on decentralized governance to ensure fairness and inclusivity in decision-making. Unlike centralized models like Binance Dashboard and Solana, we prioritize equal access to investment opportunities globally, breaking down traditional barriers to participation.

Leveraging this insight, our project aims to enhance decision-making efficiency by implementing machine learning algorithms for due diligence processes. Additionally, we will develop a user-friendly dashboard for investors and entrepreneurs to track their investment portfolios, thereby reducing the time required for portfolio management and analysis.

At the core of our innovation are smart contracts, enhancing efficiency and transparency. This revolutionizes the investment landscape by reducing opacity and manual errors found in conventional venture capital models. Through blockchain technology, we provide investors with unprecedented trust and accountability, transforming traditional investment frameworks.

Moreover, our project extends beyond mere disruption of the status quo; it actively addresses the pressing challenges facing contemporary investment ecosystems. By significantly reducing costs and enhancing liquidity, we not only facilitate greater accessibility to investment opportunities but also foster a sense of community and collaboration among investors, setting us apart from

competitors and positioning us as pioneers in the evolution of venture capital.

In essence, our endeavor heralds a new era characterized by inclusivity, transparency, and efficiency, as we endeavor to reshape the very fabric of the investment landscape for the betterment of all stakeholders involved.

IV. METHODOLOGY

Our proposed solution contains 3 major actors:

- **Investors:** Individuals investing their capital for a period of time for good returns from the investments.
- **Project owners:** They represent the startup owners who are required to raise capital for the further scaling/development of their project.
- **DAO maintainers:** They are the individuals elected to maintain the DAO and are responsible for the investment process.

The DAO was developed using the following flow which contains the 3 major actors in the picture.

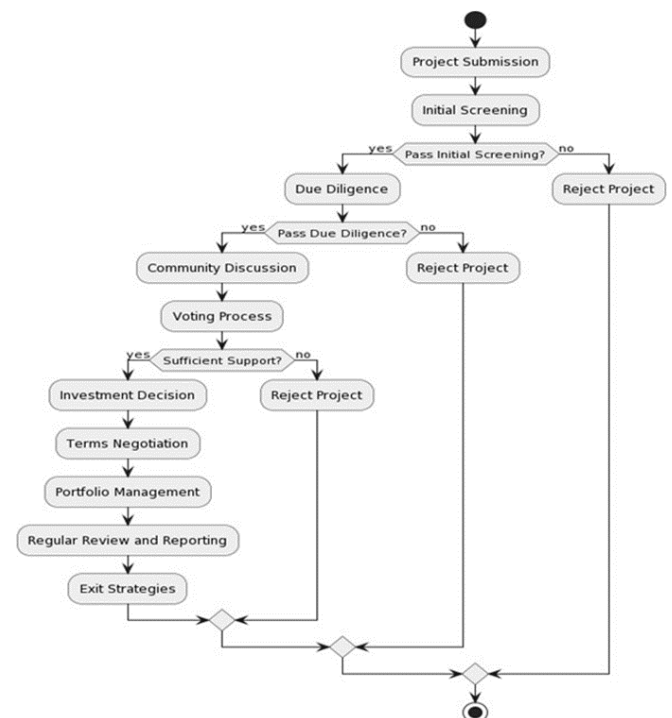


Fig 4.1: The flow of the DAO application

The application's flow, as depicted in Figure 4.1, is comprehensively elaborated below

- **Project Submission:** Entrepreneurs or project leaders can submit investment proposals through the DAO's platform. Here they share the details of their project
- **Initial Screening:** An initial screening is conducted to filter out proposals that don't meet the DAO's basic criteria. This could involve factors like the type of project, its fit with the DAO's investment thesis, or the completeness of the proposal.

- **Due Diligence:** Proposals that pass the initial screening undergo a more thorough due diligence process. This involves screening by a trained machine learning model which is discussed later in the paper.
- **Community Discussion:** Shortlisted proposals are then opened up for discussion and feedback from the DAO community. This is a comprehension of the voting process where decisions need to be made, given that the participants have staked enough tokens to get rights to decision-making.
- **Voting Process:** Investors then vote on whether to invest in a particular project or not. The voting process is likely to be built into the DAO's smart contract, ensuring transparency and immutability.
- **Investment Decision:** If a proposal receives a sufficient number of votes in favor, the DAO moves forward with the investment.
- **Terms Negotiation:** The DAO and the project team negotiate the terms of the investment, such as the amount of funding, the valuation of the project, and the rights and obligations of each party.
- **Portfolio Management:** Once an investment is made, the DAO becomes part of the project's investor group and may participate in portfolio management activities. This could involve monitoring the project's progress, providing guidance and support to the team through various communication interfaces, and participating in future funding rounds.
- **Regular Review and Reporting:** The DAO regularly reviews its portfolio companies and reports on its performance to its members. This transparency is a hallmark of DAOs.
- **Exit Strategies:** The DAO also needs to consider exit strategies for its investments. This could involve selling its shares in a project to another investor, participating in an initial coin offering (ICO), or repurchasing its shares from the project founders.

the entrepreneur prepares for a more rigorous due diligence process. Here, the DAO dives deeper, scrutinizing the ML model to screen out the project ideas based on the project's business model and financial projections, and the overall market opportunity. Proposals that survive due diligence are then presented to the DAO community for a period of open discussion and feedback. The ultimate decision on funding hinges on a vote by DAO members. If the proposal garners enough support, the entrepreneur enters into negotiation with the DAO to finalize the investment terms, including the amount, valuation of the project, and the rights and obligations of both parties. Upon successful negotiation, the entrepreneur receives the funding and becomes part of the DAO's portfolio. However, the relationship doesn't end there. The entrepreneur is expected to keep the DAO community updated on the project's progress, fostering transparency and trust. The DAO itself might also play a role in portfolio management, offering guidance and support to entrepreneurs as they navigate the challenges and opportunities that lie ahead.

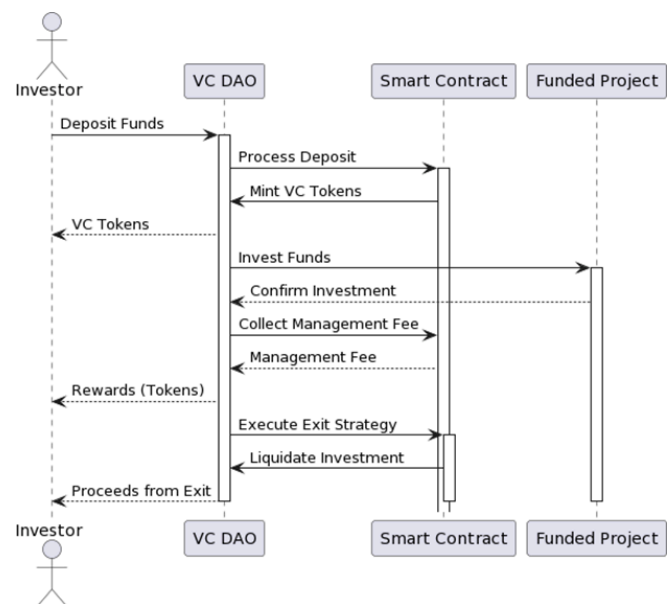


Fig 4.3 Investors Perspective

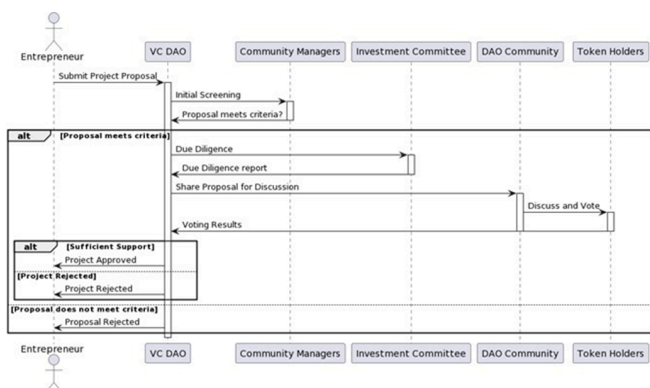


Fig 4.2: Entrepreneur's perspective

Fig 4.2 illustrates the entrepreneur's perspective. The journey begins with crafting a compelling proposal that outlines the project, its goals, its details, and the specific investment amount requested. This proposal goes through an initial screening by the DAO to ensure it aligns with their investment focus (industry, stage of development, etc.). If it passes this initial hurdle,

Similarly the investor's perspective in Fig 4.3 suggests the investor experience within our application revolves around contributing funds and receiving VC tokens that grant ownership and potential voting rights. Investors can then let the DAO members do the work of investments and track how their investments are going using the Dashboard. If an investment performs well, the investor may receive token-based rewards. Finally, when an investor decides to exit, they initiate a process to liquidate their holdings and retrieve their original funds through the DAO's platform.

During the creation of the application, it was divided into two parts,

1. ML-based due diligence screener using Shark Tank data

The screener is responsible for being a layer that acts like a filter to select only promising projects and remove projects that are out of the DAO's scope, fundamentally weak, have limitations in scaling, or are just spam. The model is trained on Shark tank data

scrapped specifically for this project. The following steps were taken.

Data Collection and Preprocessing:

The initial phase centered on the collection of data from a unique and insightful source: Shark Tank episode videos available on YouTube. Recognizing the potential of this data, a video scraping technique was employed to extract relevant information about startups' pitches, outcomes, and interactions with investors. This novel data collection approach ensured a rich dataset, reflective of real-world investment decision-making processes. The dataset was meticulously prepared for analysis. It comprised the following features

- Equity Ask
- Valuation
- Total sales
- Market cap
- Gross Margin
- EBIDTA
- Sales previous month
- Sales previous year

These parameters represent different aspects of the startups and their pitches, which indicates whether a startup received an investment offer. The preprocessing stage involved cleaning the data, handling missing values, and encoding categorical variables as necessary, setting a solid foundation for the subsequent machine learning model development.

Machine Learning Model Development:

The foundation of the ML-enabled component involves meticulous feature engineering to identify

important factors influencing funding outcomes. These features may range from characteristics of startup pitches to founder backgrounds and industry-specific parameters. Following feature selection, an appropriate machine learning algorithm is chosen, considering the predictive task of forecasting funding success.

Table 1 presents the performance metrics of various machine learning models used to predict the success of startups. The models evaluated include Logistic Regression, K-Nearest Neighbors (KNN), Support Vector Machine (SVM), Random Forest, and Gradient Boosting. We chose the Gradient Boosting model due to its superior predictive accuracy and robustness compared to other models. Its ability to handle complex datasets and improve forecast precision made it the optimal choice for refining investment decisions in the venture capital domain, demonstrating its effectiveness in identifying high-potential startups

In summary, considering Table 1 the SVM and Logistic Regression models exhibit the highest accuracy and recall scores, indicating their ability to correctly classify successful startups. However, their precision scores are comparatively lower, suggesting a slightly higher rate of false positives. Random Forest and Gradient Boosting models show balanced performance across multiple metrics, with Random Forest achieving a higher AUC score, indicating better overall classification performance. KNN performs reasonably well but has slightly lower accuracy compared to other models. These findings suggest that SVM, Logistic Regression, Random Forest, and Gradient Boosting are promising approaches for predicting startup success, with Random Forest performing slightly better based on the provided metrics.

Model	Accuracy	Precision	Recall	F1-score	AUC
Logistic Regression	0.8000	0.8000	1.0000	0.8889	0.4444
KNN	0.7500	0.8235	0.8750	0.8554	0.4678
SVM	0.8000	0.8000	1.0000	0.8889	0.4947
Random Forest	0.7667	0.8148	0.9166	0.8627	0.6475
Gradient Boosting	0.8000	0.8333	0.9375	0.8823	0.6284

Table 1 Comparison of different ML models on Shark Tank data

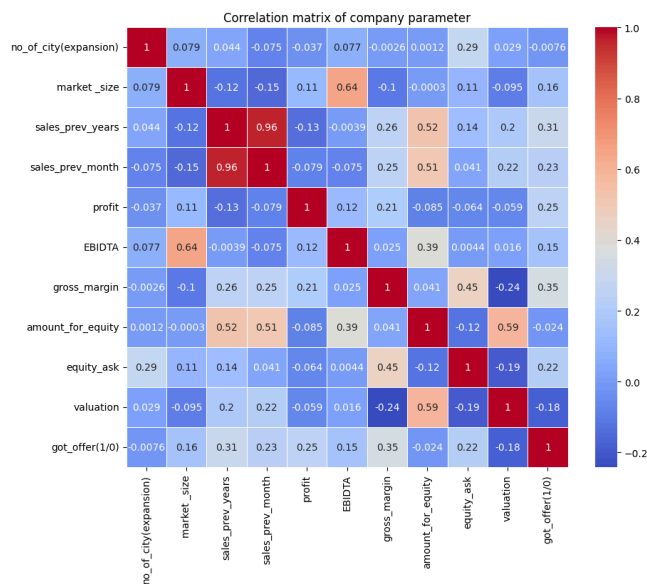


Fig 4.6 Correlation matrix

Correlation matrix of company parameter

Additionally, a correlation matrix as shown in fig 4.6 were generated to explore the relationships between different features and their impact on investment outcomes. Fig 4.7 represents the top 5 features with the highest correlation to receiving an investment offer visually represented, offering valuable insights into factors that may influence investors' decisions.

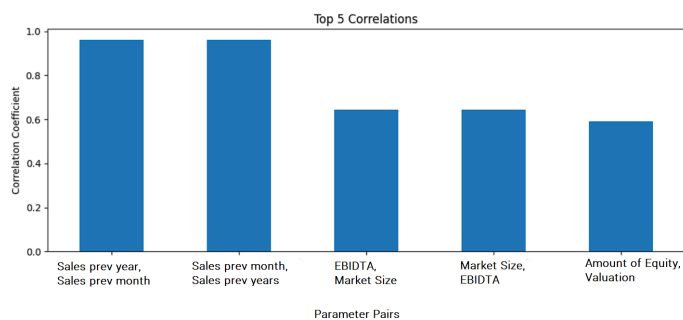


Fig 4.7: Top correlations between parameters

The methodology outlined for the ML-based due diligence screening represents a comprehensive and innovative approach to enhancing venture capital due diligence processes. By integrating machine learning into the evaluation of startups, the venture capital DAO aims to achieve greater efficiency, objectivity, and predictive accuracy in investment decision-making.

2. Writing smart contracts with main functionalities for the DAO

The implementation phase of the Blockchain-based DAO begins with the development of smart contracts, serving as the foundational framework governing the DAO's operations. These contracts are meticulously crafted to enforce transparent, decentralized decision-making and facilitate seamless interactions among participants.

A native token is created to represent ownership and voting rights within the DAO, while functionalities such as staking and unstaking mechanisms are integrated to incentivize participation and foster engagement.

Further, a robust voting mechanism is devised, allowing DAO participants to collectively decide on funding projects based on consensus-driven principles. Additionally, provisions for participants to exit from projects by selling native tokens are incorporated, ensuring flexibility and liquidity within the DAO ecosystem.

The methodology for implementing a Decentralized Autonomous Organization (DAO) within our venture capital application revolves around a sophisticated architecture designed to leverage the Ethereum blockchain's capabilities. At its core, DAO operates through smart contracts, self-executing code residing on the Ethereum blockchain. These contracts define the rules, procedures, and governance mechanisms governing the venture capital fund. Participants engage with these contracts to stake Ethereum tokens, which in turn confer voting rights and influence over decision-making processes within the DAO.

Staking Ethereum tokens is a fundamental aspect of the DAO's functionality. Participants lock a predetermined amount of Ethereum tokens into smart contracts for a specified duration. The amount staked determines their voting power within the DAO, creating a direct correlation between token ownership and decision-making influence. Through the transparent and immutable nature of the blockchain, smart contracts autonomously calculate and allocate voting rights to participants based on their staked tokens.

The voting process within the DAO is integral to its operation. Participants cast their votes on investment proposals and other matters of governance using their allocated voting rights. Smart contracts facilitate the voting process, recording and tallying votes to reach a consensus. The transparent recording of voting activities on the blockchain ensures accountability and integrity within the DAO, fostering trust among participants.

Furthermore, the DAO operates within a predefined governance framework outlined in its smart contracts. This framework delineates the rules and procedures for proposal submission, voting, and decision execution. Participants adhere to this framework, ensuring the efficient operation and integrity of the venture capital DAO.

Integration with the broader Ethereum ecosystem enhances the functionality and utility of the venture capital DAO. Leveraging existing Ethereum infrastructure facilitates seamless transaction processing, token transfers, and integration with decentralized finance (DeFi) protocols. Interoperability with other Ethereum-based applications expands the reach and capabilities of the venture capital DAO, enriching its ecosystem.

The DAO network acts upon our application considering the following data flow diagrams which define the structure of the application.

Once the smart contracts and governance mechanisms were coded and tested locally, they were deployed onto the Ethereum blockchain using tools like Hardhat and Remix. The deployment involved compiling the smart contracts into bytecode and then deploying them to the Ethereum network, where they became immutable and publicly accessible.

Further, we have integrated the DAO ecosystem with an interactive frontend over the NEXT.Js framework using various Web3 libraries. The users get to access a real-time dashboard showing the performance of their portfolio and similarly, the investor gets to view the performance of the startups over the web application as shown in fig 4.10

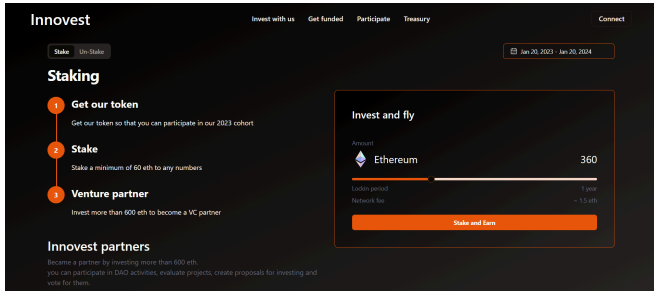


Fig 4.8; UI dashboard of Staking

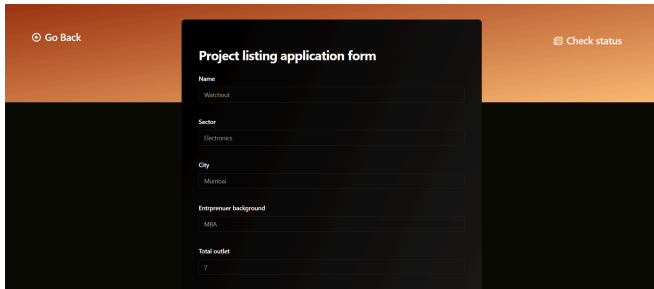


Fig 4.9; UI dashboard for Project Proposals

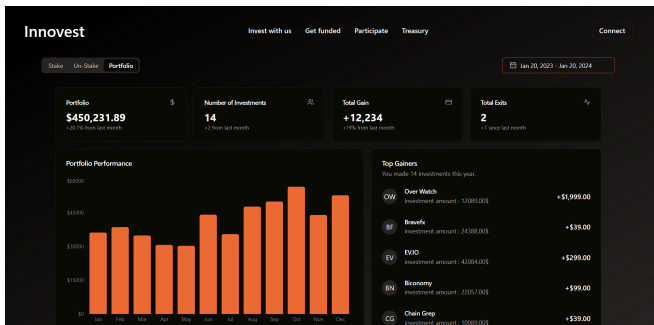


Fig 4.10 Personal Portfolio

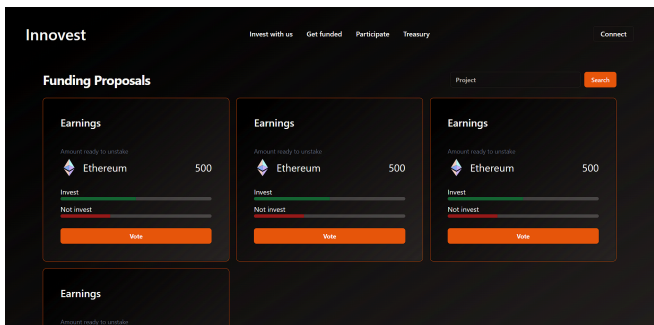


Fig 4.11: Voting on projects

V. Future work

Our future work also entails devising comprehensive exit strategies for startups that receive funding through our venture capital DAO. These exit strategies are vital components of our investment framework, as they not only ensure the financial success of our investors but also play a crucial role in the overall growth and sustainability of the startup ecosystem.

One of the primary exit strategies we will explore is acquisition. In this scenario, we will actively seek potential buyers who are interested in acquiring the startup, thereby providing an attractive exit opportunity for our investors. We will leverage our extensive network and industry connections to identify strategic buyers who can offer the best value for the startup and its shareholders.

Another exit strategy we will consider is mergers. Merging with another company can provide significant growth opportunities for the startup while also offering an exit path for our investors. We will assess potential merger partners based on their compatibility with the startup's business model, strategic objectives, and growth trajectory, ensuring a mutually beneficial outcome for all parties involved.

Additionally, we will explore the option of initial public offerings (IPOs) as a viable exit strategy. Going public can unlock new avenues for growth and expansion for the startup, while also providing liquidity for our investors through the sale of their shares on the public market. We will work closely with our legal and financial advisors to navigate the complexities of the IPO process and ensure a successful transition to the public markets.

Overall, our commitment to implementing robust exit strategies underscores our dedication to fostering a thriving startup ecosystem and delivering maximum value to our investors. By carefully evaluating and executing these exit strategies, we aim to create sustainable long-term returns for our stakeholders while catalyzing growth and innovation in the ventures we support.

VI. Conclusion

In conclusion, the Venture Capital DAO stands as a testament to the transformative power of cutting-edge technological innovations within the realm of venture capital and startup funding. The successful implementation of this project has brought forth several technical achievements that redefine the landscape of investment and idea incubation. The integration of blockchain technology has been a pivotal aspect of the Venture Capital DAO's architecture. Through the use of blockchain, the platform ensures immutable and transparent record-keeping of all transactions and investment activities. This not only minimizes the risk of fraud and manipulation but also provides an auditable history of investment decisions and fund allocation. The decentralized nature of blockchain further enhances security by eliminating single points of failure and potential vulnerabilities associated with centralized databases.

Smart contracts, a cornerstone of blockchain functionality, have been leveraged to automate and execute various processes within the Venture Capital DAO. These

self-executing contracts enable seamless, trustless interactions between investors and project initiators. By codifying investment terms, dividend distributions, and project milestones, smart contracts remove the need for intermediaries, reduce administrative overhead, and ensure that the agreed-upon terms are upheld with precision. Furthermore, implementing decentralized autonomous organization (DAO) principles within the Venture Capital DAO has redefined governance and decision-making. The incorporation of token-based voting mechanisms empowers investors with a direct say in project funding and management. This democratic approach not only fosters community engagement but also ensures that funding decisions are reflective of the collective wisdom of the platform's participants

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