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Website: ijcs.stmikindonesia.ac.id | E-mail: ijcs@stmikindonesia.ac.id

Promoting Scientific Research: rNFT and DeSci Conjunction

Ilman Shazhaev [1], Arbi Tularov [1], Dmitry Mikhaylov [3], and Abdulla Shafeeg [2]
ilman@farcana.com, arbi@farcana.com , dm@hypermindlabs.com,
abdulla.shafeeg@farcana.com
[1] Management, Farcana, Dubai, UAE
[2] Science, Farcana, Dubai, UAE
[3] Hypermindlabs, Dubai, UAE

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Abstract

NFTs are non-fungible tokens. Like cryptocurrencies, they appeared as a result of the formation of the blockchain. True, unlike, say, Bitcoin, each NFT is unique and has its own value. If one conventional cryptocurrency unit does not differ in any way from another similar one (for example, one Ethereum does not differ in any way from another and is completely interchangeable without loss of value), then the situation is different with NFT. Tokens are used to secure rights to a unique object, such as a digitized work of art or artifacts in video games. Tokens are stored in the blockchain and contain the address of the object. To store the metadata and media to which the tokens are assigned, the InterPlanetary File System (IPFS) file system distributed over many computers is most often used. Farcana has suggested applying the same principle to scientific research. By introducing the MetaDeSci, Farcana has created a space where the gamers, gaming platforms, investors, scientists and universities are capable of using the rNFT to finance research, share data and promote science altogether, maintaining transparency.

A. Introduction

Blockchain is one of the most promising information technologies of our time. However, its use in the financial sector (bitcoin, ether, and other cryptocurrencies) received the most significant response in 2017-2018, when distributed ledger technology (DLT), as blockchain is more neutrally called, has begun to take root in various sectors of the real economy and public life, even far from the "digital frontier." First of all, these are banking, logistics and retail, healthcare, public administration, elections, and so on.

Why has blockchain generated such interest? A distributed registry is just a way to store information: blocks of data are connected using cryptographic tools so that it becomes impossible to change one block's content without violating the entire database's integrity (ur Rehman et al., 2019). Within such a system, all transactions are transparent, and information about them is copied to the computers of all participants. Thus, decentralization is achieved, which does not allow data to be manipulated or destroyed by hacking the "core" of the system (ur Rehman et al., 2019; Ante, 2022).

Cryptocurrencies (Bitcoin and others) have made blockchain a successful technology by combining several essential properties: cryptographic tools, a mechanism for reaching consensus within the system in user mistrust towards each other, and rewarding network participants for maintaining its operation (mining). They have won the attention and resources of thousands of people (their money, time, machine power) by creating a means of payment that does not depend on the authority and tools of the central bank, courts, and police – where the computer algorithm itself acts as a guarantee that the user will not be robbed and not deceived (Bashir, 2020). In addition, cryptocurrencies provide trust within the system (whose participants do not trust each other) and act according to predetermined rules (usually transparent as the software is posted in the public domain). Users can change these rules under certain conditions (for example, make a fork, namely a branch of the cryptocurrency with new rules). Finally, cryptocurrencies provide a certain degree of anonymity for transactions (Bashir, 2020).

Background

However, where is there room for science in this case? First of all, the blockchain, a distributed ledger technology outside the cryptocurrency sphere, promises to improve various "big" systems of the economy, politics, and society. Its key advantages are the guarantee of data stability, trust among entities that do not trust each other, and successful interaction between these entities without the need for a central governing body. To put it very briefly, the Internet has revolutionized by reducing transaction costs for information exchange and communication (from days and hours to seconds), and the blockchain for interaction and management (of a wide variety of resources, including people, money, information) (Bashir, 2020).

In a distributed ledger, data is transparent; is verifiable; is an immutable (it is technically impossible to change them retroactively without

leaving a clear trace in the system); is distributed over different nodes, in many copies; is decentralized (included and removed from the system subject to the consensus of all participants, and not one central node of power) (Ante, 2022).

One can discuss a typological similarity between science and blockchain: it is decentralized (no primary authority decides everything). It develops thanks to networks of trust and agreements within the community (modern peer review or the medieval mechanism of opinion communis doctorum) (Niya et al., 2019). Or, to put it another way, scientific data is, at its core, a large, dynamic body of information that is collectively (collaboratively) created, modified, used, and shared — which fits perfectly with blockchain technology.

Yet the social aspect of research and its publications is still relatively closed and opaque. It is imperative to note how the choice of reviewers for a manuscript is submitted to the journal, or how generally the decision to publish the manuscript is made. It is still not very open as to who assesses the manuscript, and what indicators are considered in the process (Bartling, 2019). At the same time, the author of the research does not entirely know the knowledge level and credentials of the assessor. How is one to know if the one assessing the manuscript is proficient in the topic and will actually know what it is that he/she is reading (Bartling, 2019). The relative secrecy of these processes from the scientific community, their inertia, bureaucratization, and corruption often cause justified dissatisfaction among scientists. The researchers' work is no less far from the ideal of open science. It is also replete with somewhat unethical facts such as twisting data to achieve the desired result, fitting data to hypotheses after the fact, or outright manipulating source codes (Dabbagh, Sookhak, & Safa, 2019). The blockchain in science can at least bring some of these facts out in the open and clarify the process of publishing making everything more open, reliable, and efficient (Dabbagh, Sookhak, & Safa, 2019).

B. Literature Review

Blockchain and Web 3

It is reasonable to ask - if the prospects for using blockchain for science are so bright, then where are the successful cases? They are still in the process of development, which is not surprising. Unlike digital finance or, for example, gaming, science is a very conservative area that does not promise big quick profits (Voshmgir, 2020; Wang et al., 2022). The first serious discussions about the use of blockchain in science and the first academic publications on the topic began to appear only in 2016-2017. At the same time, at the peak of the speculative boom of cryptocurrencies and ICO8 in 2017, several startups announced themselves and began to attract investments, promising to solve all the problems of science with the help of blockchain - and free it from oligopolies and corporate interests, and provide powerful material incentives for scientists, and to create from scratch a fairer and more efficient system of publications, and in general to save science from distortions (Potts & Rennie, 2019). Some of these startups are dubious schemes for quickly raising money under beautiful slogans (Globex. sci,

scientificcoin.com). In contrast, others are somewhat idealistic projects that may eventually become more realistic (scienceroot.com, frankl.io, orvium .io). I see much more promising projects that set more modest goals and offer blockchain solutions for some aspects of scientific activity (peer review, scientometrics, distribution of funds) (Sheridan et al., 2022).

According to Blockchain (Market Research Future, 2022), the Web3 market size is estimated to be over $6.3 billion and is projected to grow at an annualized rate. Growth rate. (CAGR) by 44.6% from 2023 to 2030. While many industries and institutions are using the emergence of this Web 3 to spur innovation, scholars are also exploring its applications (Market Research Future, 2022).

Today, many scientists have already implemented blockchain tools, such as smart contracts, decentralization, etc., to revolutionize the world of science. This movement toward using blockchain and web applications 3 is called Decentralized Science (DeSci). Although DeSci is still in its infancy, it is the meeting point of two significant movements: the aspiration of the scientific world to seek alternative ways to fund their work and to share information and data without restriction (Abuhashim & Tan, 2020). A cryptography-based movement to eliminate profit-oriented intermediaries from exchanges of value or transactions.

There is a lot of partiality in the financing of science, cumbersome, non-transparent, and inefficient procedures - those same opaque spots (Bartling, 2019; Dabbagh, Sookhak, & Safa, 2019). In addition, scientists have to spend a considerable part of their time not on research but on writing reports and applications for grants and other bureaucratic tasks.

Finally, an acute problem worldwide is the reduction in funding and, in general, the fall in the freedom of scientists - the freedom to choose the direction of work and receive the necessary funds for it (Ding et al., 2022). The state (in various world countries) is gradually moving away from large-scale scientific research funding, hoping that business, industry, and private foundations will replace it. And they are either in no hurry to take on this burden or prefer more applied and short-term projects (which "dries up" many areas) (Ding et al., 2022).

How will distributed ledger technology be helpful in this area? For example, it will reduce the likelihood of abuse in the financing of scientific research: expert opinions, decisions made, and allocated funds can be presented on the blockchain, where any fraud will be visible (Sheridan et al., 2022). In general, a working automated system for distributing funds by fixing transactions on the blockchain can significantly reduce the burden on accountants, auditors, fund employees, and scientists, saving them from filling out paperwork.

The new technology will help to build relationships between, on the one hand, funds, investors, other organizations that finance science, and, on the other hand, scientists. Smart contracts will automatically link the allocation of funds to the fulfillment by the grantee of certain conditions, for example, the submission of a report on time or publication in a journal with specific characteristics (Potts & Rennie, 2019). Another option is to build an option to automatically return funds to the fund in case of fraud or irreproducible results.

Finally, the advantages of blockchain concerning the financial sector (reducing transaction costs, transparency, reliability) facilitate experiments with fundamentally new mechanisms for distributing funds for science, for example,

systems, where scientists are required to distribute 50% of the received grant among their colleagues, or where money is allocated through lotteries.

Over the years, significant efforts have already been made to make research results and data more accessible to the general public. Open science has played a vital role in this regard. Its main contribution is to defend the National Institutes of Health's injunction requiring all scientific results to be published without restricting access. However, the journals have responded to the injunction by ensuring that scientists are paid before their work is published. This hurdle required a more revolutionary approach, leading to a decentralized science revolution.

What is decentralized science?

Decentralized Science (DeSci) is the latest potentially revolutionary Web 3 movement that seeks to use technology applications such as blockchain and Web 3 to solve some big scientific research problems (Wang, 2022). These pain points include the hurdle associated with the lack of research results and other research and scientific process bottlenecks.

Once DeSci would be fully accepted by the scientific community, there will be a significant shift in science funding, and knowledge will no longer be stored in repositories (Ducrée et al., 2022). DeSci is capable of taking power away from profit-hungry intermediaries such as publishing conglomerates and strengthen collaboration within the global scientific community. Many scientists struggle to access the proper funding. Scientists generally spend nearly 50% of their time preparing various reports and research proposals, and they are never guaranteed that their proposal will be seriously considered (Ducrée et al., 2022).

Restricting access to scientific discoveries and data is another big problem plaguing today's scientific world. While science is thought to save lives, people need permission to access its data. The main task of DeSci is to provide unrestricted access to these scientific data to the general public (Wang et al., 2022).

Science-based blockchain initiatives began to gain global recognition in 2021 with the emergence and proliferation of new projects. Examples include the Open Science NFT project, sold for 13 ETH, and the boom of DAOs created to support and assist decentralized scientific research. In addition, a DeSci panel discussion was held at the LisCon blockchain event in the last quarter of 2021 (Wang et al., 2022).

The current decentralized scientific ecosystem is an interconnection of various DAOs. Each of these DAOs is designed to serve a specific niche of research output, such as funding, peer review, unlimited access, etc. However, DAOs are initially designed to serve specific research areas, such as biotechnology. Biotechnology DAOs are at the forefront with DAOs such as Molecule DAO.

How DeSci will use blockchain and Web3

Expert checks based on smart contracts. Although scholars provide peer reviews for free, the middleman publishing industry makes enormous profits.

Integrating intelligent contracts allows DeSci to eliminate the mediators in peer review, thus allowing authors to interact directly with reviewers (Ding et al., 2022).

Over the years, there have been indications that governments have interfered with and censored scientific research and findings. Newman (2006) published a report stating that the politicization of science is so relevant that it appears in comic strips of the main newspapers.

DeSci uses the decentralized property of blockchain technology to store data, thereby making it accessible from all over the world. This will help mitigate government censorship and control over scientific data (Wang, 2022).

Blockchain Research Funding

Using the innovative feature of decentralized autonomous applications, scientists can team up to launch to fund their research. There is also the possibility of creating platforms dedicated exclusively to science. They can also use DeFi systems to create sustainable and efficient research funding models (Potts & Rennie, 2019).

Harnessing the value of market outcomes such as NFTs can help fund research, thereby strengthening sustainable scientific communities.

NFT Use

NFTs have enormous potential to disrupt many different industries. Of course, we've seen NFTs take root in collectibles, arts and entertainment, and fan engagement (this is certainly not an exhaustive list). Now more and more people and organizations are paying attention to the potential of NFTs in various unique roles in science and research.

Stanford University professor and neuroscience and ophthalmology researcher Andrew D. Huberman (2021) said over the weekend that "Several labs are starting to sell NFTs as alternative/additional sources of research funding" with this tweet:

> “Well, I think it will start sooner than I expected: several labs are selling NFTs as alternative/additional sources of research funding. Soon we can expect "first images of X under the microscope," etc. Wild! #NFT #science #Biology #BTC”

Huberman also runs the Huberman Lab at Stanford Medical School and frequently discusses neuroscience and the nervous system on his Huberman Lab podcast. As with most NFTs, the further evolution is far from clear. However, the potential is there. In response to the tweet, Huberman mentioned that if labs can fund themselves, it will change the landscape of science forever (Huberman, 2021).

This is the essence of cryptocurrency. There is potential to create a decentralized institutional body or structure that will fund necessary development research without prioritizing the interests of third parties.

Huberman is not the first to think about this. Huberman's responses repeatedly mentioned the VitaDAO project and his own VITA token, a DAO focused on funding research to extend human lifespan and health (Ding et al., 2022). As the total market capitalization of cryptocurrencies hovers near all-time highs, so does the potential for NFTs to explore new use cases for innovation in science and research. VitaDAO then acquires or commissions research and owns, develops, and monetizes the generated IP. In the meantime, VITA token holders contribute to VitaDAO's decision-making and research management, voice opinions on specific initiatives, and manage DAO's data repositories and IP portfolio. VitaDAO and the innovators at UC Berkeley are far from being just those who want to take a fresh approach to research and funding.

Farcana rNFT Solution

Following in the wake of the current trends, Farcana has suggested a seemingly obvious solution, which, nonetheless, has not been offered before. This suggestion is the creation of a MetaDeSci platform capable of bringing together researchers, gamers, and investors, simplifying the process of investing and obtaining funds for research, and at the same time strictly abiding by the rules.

Utilizing the benefits of NFT implementation, as well as their rocket-speed spread and increase in popularity, Farcana is keen on promoting their use as investment incentive for the development of science and research benefits. Traditional NFTs differ in a number of features, including their rarity and the difficulty of duplicating or counterfeiting them. However, the NFT holder is somewhat limited by the unique nature of these tokens in that they cannot be used interchangeably. This sparked a creative approach in the field of NFTs, giving rise to two promising new ideas: dynamic NFTs and fractional NFTs. At the same time Farcana is suggesting the application of rNFT as in research NFT, which are programmable and makes IP more discoverable. This is especially useful for academic data where there is no efficient way to find proof of it.

With the help of rNFT, Farcana is able to solve several tasks:

1. Quick access to funding. Some researches require an immense amount of funding, which is difficult to acquire from a single investor or grant giver. Through the application of rNFT as a small NFT, Farcana is able to democratize the market, thereby giving smaller investors the chance to participate at a price affordable to them. Thus, investors have the opportunity to be part of the largest and most expensive research overall.

2. Quick access to potential data donors. Research requires a large amount of data, which is rarely available to scientists. Spending time gathering information is a waste. This problem is easily resolved through MetaDeSci and rNFT. Farcana suggests applying its potential to allow scholars donate/share their data through rNFT purchase. As this is only a fraction, many more people will be enticed to participate and share data. This will increase the data pool allowing scientists to get the data that they actually need.

3. Millions of players in countries where gaming is the main source of income have easy access to money. "Go-Earn" games reward players with cryptocurrency just for practicing. Although, such games usually have an entry

barrier in the form of high initial purchase prices that most players with limited funds cannot afford. MetaDesci from Farcana allows different game platforms to create in-game maps for data donors. Donors buy a portion of rNFT to play a game that can later be exchanged for money.

4. Achieving well-being and skill improvement. Gaming Concerns are often expressed in the media that excessive video game addiction is harmful to health and can alter one's worldview. However, there is some uncertainty in the scientific data. A number of studies have found both positive and negative outcomes associated with gaming. Providing users with an engaging experience is critical. A game needs rules, puzzles, and a central theme to keep players engaged. Problem solving can be taught in a variety of ways, including quizzes, drag-and-drop exercises, role-playing games in which the player must choose appropriate language or actions, and adventure games with missions and objectives to complete. You can also create games that require players to memorize information, pay close attention, and even work together to achieve goals. When time is of the essence, it helps to add excitement to problem solving. In addition to the relevance of the health-related goals themselves, game reward and feedback systems should emphasize these milestones.

5. An underfunded scientific market can capture a significant portion of excess liquidity stored in cryptocurrency. Fragmentation of NFTs solves their liquidity problems. When submitting a proposal for a project with an expensive rNFT, one will have to wait, because few investors can afford it. rNFT, on the other hand, allows to split one ERC-721 token into multiple ERC-20 tokens and sell each token independently. These fractions of rNFTs have a lower price, which makes them easier to trade and creates liquidity, allowing excess cryptocurrency liquidity to be channeled into underfunded scientific markets.

Overall, Farcana suggests to introduce the rContract, a certain option for the research Smart Contract that is to be implemented in the MetaDeSci. Developed on the Ethereum blockchain and being publicly available is a certain benefit at https://github.com/FarcanaLabs/rNFT. This will allow all parties involved (players, gaming platforms, investors, and scientists) to participate in and promote an open and important experiment. Naturally, each will play their respective role in all this:

- The players, can participate and receive a share of rNFT to play cards provided by gaming platforms. They donate data that is very valuable to the experiment, and in return they can earn by selling rNFTs afterwards on the crypto exchange.
- Game platforms provide cards for suggested experiments. By creating maps, they get the opportunity to participate in experiments and receive rewards. In addition, by purchasing in-game items with rNFT, gaming platforms receive additional revenue.
- By investing cryptocurrency in projects proposed by scientists and universities, investors get the portion of rNFT they deserve. The affordability of rNFT makes it easy for a single investor to own parts of the IC for multiple projects, and this makes rNFT attractive.

- Scientists and universities. Universities and scientists initiate the system by proposing an experiment, the rNFT for the experiment is minted and crushed. They can own rNFT fractions themselves and receive rewards.

C. Discussion and Analysis

Blockchain in science is gradually taking shape in a single movement of like-minded scientists — and unites their dissatisfaction with the state of affairs in science: the oligopoly of large publishing houses, the pursuit of quantitative indicators and indifference to the quality of work, the concentration of power and influence in the hands of narrow "cliques," a growing number of frankly low-quality and non-replicable studies) (Ding et al., 2022). They came out mainly from the natural sciences (especially biomedical and physics), far from marginalized, but not elite either - they are postdoc-level researchers and young teachers, plus a certain number of IT specialists and startups (Potts & Rennie, 2019). Blockchain attracted them with the promise of radically reshaping the rules of the game in science: transparent transactions and decision-making, tokens as flexible incentives, decentralization, and the ability for scientists to determine what is essential (for example, to encourage research whose results can be used in other work) (Potts & Rennie, 2019). In general, blockchain enthusiasts share the values of open science.

However, in such a "revolution from discontent," there are strengths and weaknesses. Strength—because it motivates us to invent new and unusual ways to solve problems plaguing science. Weakness - because the revolutionary situation is not (yet) successful, and the broad masses of scientists, although they often grumble, generally accept the established practices and rules of the game. A good example is the distributed citation registry project, which is maintained by the academic community and not by the private companies Elsevier and others (Abuhashim & Tan, 2020). The idea is interesting, but Scopus and Web of Science set the quality standards and are accepted as a source of scientometric indicators by most scientists, but difficult to implement in the foreseeable future.

Indeed, even in science, blockchain technologies can both empower scientists, give them more autonomy, make their lives more convenient, and become an instrument of supervision, further strengthening the already heavy burden of reporting and permanent control over the activities of scientists. When a scientist uploads data, works with it, writes or submits an article, writes a review, all this is automatically tracked and recorded (Wang et al., 2022). When working on the blockchain, the risk of fraud is much lower, and collecting reliable and complete data on the work of researchers, scientific groups, and universities is easier. Therefore, based on this data, it is possible to build more accurate and reliable metrics.

No dominance of ownership by one legal entity. The main disadvantage of Open Science was the risk that one commercial platform would "own" the science. However, the advent of DeSci ensures that unique, specialized communities will be dedicated to a specific niche of scientific research. In addition to reducing the likelihood of one organization dominating science, DeSci also protects the scientific

community from rapidly advancing technologies and other emerging threats (Wang, 2022).

With DeSci, scientific knowledge will belong to people, not corporations and governments. Imagine the possibility that communities would set the prices for vaccines, and the bulk of the profits generated would be reinvested in funding more research. This will surely improve everyone's wellbeing.

Verified reputation. Today, a scientist's "credibility" and his ability to secure funding depend on the number of his publications. With DeSci, such scientists can earn NFTs by performing some value functions for research purposes. A scientist can train and mentor young professionals in the field, participate in peer reviews, and share data without restrictions. NFTs can serve as verifiable evidence that a scientist has contributed significantly to science.

D. Conclusion

Decentralized science is a relatively "young" trend that is trying new technological tools to revolutionize science. Before DeSci can be successful, its tools must be ubiquitous in scientists' daily work. DeSci's focus should be on providing scientists with all the necessary tools to be efficient and effective in their work. Everything else is secondary. By utilizing the existing progress, Farcana has found a solution in the development of MetaDeSci capable of uniting all parties and providing them with an ultimate scientific experience funded by rNFT, and at the same time promoting science and data sharing.

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