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DeSci Advancement and Gamification – Virtual University as A Model

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Abstract

The existing model for knowledge dissemination that universities and research centers adopt relies on central funding and central repositories of publications and books which are for the most part guarded by pay walls. These central repositories manifest as for-profit Publishing houses. While the editing and peer review processes are fully voluntarily performed by experts in the scientific field, the outcome of the scientific work i.e. the publication remains under the publishing house ownership accessible only by paying an exorbitant fee. In conjunction, conventional brick and mortar universities nowadays stand as the main knowledge creation flocked by students. Again, access to these educational institutions and/or to research funding require substantial effort and/or cost from students and scientists alike. In this work we present a new model for the creation and dissemination of knowledge relying on the DeSci approach and crowd funding. The model circumvents many if not all of the deficiencies of the existing centralized approach.

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A. Introduction

Blockchain technology is continuing to develop, influencing through its evolution the scientific field. Scholars and scientists can now utilize blockchain technology, thereby improving their scientific collaboration, financing, and regulation of their activities with various stakeholders. Blockchain is helping to decentralize the whole field, leading to the development of the so-called DeSci movement combining blockchain and Web3 to improve and revitalize the possibilities of scientific research. Decentralization products are used by an increasing number of people in various fields (Wang et al., 2022). The evolution of cryptocurrencies and DeFi (Decentralized Financing) have influenced modern finances, whereas NFT is changing the art market. In a business environment, the factor of change is DAO. However, the DeSci phenomenon has emerged at the intersection of science, art, and entrepreneurship to change approaches to scientific development and research (Wang et al., 2022). This movement arose in response to the excessive concentration of resources necessary for developing science in the dominant scientific and information centres, which can restrict access to these resources for their purposes (Ducrée et al., 2022). Access to funding, data, and advanced tools in our time can be limited for various reasons, and as the reality of recent days shows, politics is one such reason.

In conjunction, research in soft sciences is an important foundation of economic growth. Soft sciences are sciences relying on computer-based experiments/codes for research. Examples include: AI, Mathematics, Computer Sciences, Computational Chemistry, and Computational Physics. For these sciences, the brick-and-mortar model in universities is still the dominant model despite its numerous deficiencies. The deficiencies include high overhead due to the physical location requirements and bureaucratic systems needed to conduct managerial activities which lengthens the enrolment process among other processes …etc. Furthermore, conducted research is typically funded by governmental or private grants which undergoes a long and tedious bureaucratic process that takes from 6 months to a year. Commercially, strong evidence supports the notion that the brick-and-mortar model utterly fails in front of the virtual model whenever the latter is viable.

As the underlining principal DeSci addresses the aforementioned deficiencies. The main goal of DeSci is to increase participation and funding in solving scientific problems, as well as to democratize the peer review process, which is dominated by a few journals (Ducrée et al., 2022). DeSci can also create standards for storing research results through proof-of-existence technology. If a network of miners verifies transactions in financial blockchains such as Bitcoin, then research could also be verified by blockchain network members of scientists.

DeSci aim is to create a decentralized environment that allows you to create a self-regulating system for obtaining and disseminating knowledge, scientific research, literature, and art, as well as a fair distribution of funding for scientific research and various research without barriers and a first step towards deliberation of science and universities. Moreover, this new approach has the capacity to eliminate the intermediary between researchers and reviewers.

DeSci, being a decentralized environment, allows for creating an automated system for obtaining and disseminating knowledge, scientific research, works of literature,

and art, and a fair distribution of funding for scientific research and various research (Ducrée et al., 2022). To this, we can add the possibility of free expansion of cooperation between scientists in these areas without any borders and intermediaries. In this work, we discuss the advantages of DeSci and its impact on the field. We also present an implementation model for DeSci.

B. Literature Review

The development of blockchain technologies has provided an opportunity for increasing the transparency processes in various industries (Upadhyay et al., 2021). Only a few years of action saw the creation of blockchain from Bitcoin and multiple payment systems, which opened up new facets of its usefulness for humanity (Upadhyay et al., 2021). These solutions have introduced decentralization to finance, art and business (Clincy & Shahriar, 2019). These spheres have received more opportunities for people to develop their creativity and talent. Considering NFT, DeFi, the development of metaverses, and web 3.0, it is not surprising that the subsequent discovery was DeSci - decentralized science.

In recent years, breakthroughs have occurred in many areas of science (Cai et al., 2018). Well-known examples include RNA vaccines, genetic engineering, and thermonuclear fusion successes. However, science develops as an entire field, or, on the contrary, does its system, which has been established for years, hinder the emergence of new essential studies?

Problems in the field of science

Science is highly centralized and is often controlled by state institutions. Scientists have their hands tied because they depend on funding and approval from some regulators who decide what to research (Cai et al., 2018). Governments often have preferred industries, such as medicine and IT, and areas, with little to no attention, like climate change research and state carbon footprint. Scholars and scientists have assisted in creating the DeSci movement, promoting new platforms to speak about problems of global scientific importance (Ducrée et al., 2022).

Yet, funding research still remains one of the largest challenges scientists face to prove/disprove an idea/technology. Scholars spend a lot of time filling out grant applications (Cao, 2022). However, they may never see the money for their ideas because their field affects someone else's business interests. The scholars may not rank high enough in the global community, or government institutions don't care about their field of study.

Another problem is related to access to research information. Placing a publication in the most influential scientific journals is expensive, making it difficult for people to tell the world about their ideas/findings. More so, such publications, which do appear, are often criticized for being funded by a single organization or fund, with claims that the material is published only if it fits the general policy of the organization or fund.

Political interference and the lack of transparency are other problems to be tackled. People managing research funding are often subjective. This also concerns situations when magazines and journals have a specific list of scholars, scientists, and institutions from which they accept articles for publication. No different is the problem with governmental officials who, in the case of pharmaceuticals and

medicine, lobby the interests of these companies and determine governmental policy towards a particular medication or even method which best suits the companies mentioned above.

Currently, the difference between creating a DeSci publication and utilizing the traditional tools of publicizing a paper or information about technological advancement is that using the DeSci-platforms, one can fundraise the necessary amount through the DAO. In contrast, before, one had to find an organization willing to fund the entire research/experiment (Wang et al., 2022). At the same time, the publication is checked by the journal experts who may/may not be proficient in the topic that one is submitting. Yet, one is still forced to come up against the subjective human factor. However, DeSci-platforms provide a scientific approach using evidence technology.

Although the Internet helps to get information from anywhere in the world, not all data can be accessed. Many scientific materials are stored on paid platforms, or only part of the information is published on websites. Various projects have already tried to solve this problem. Some scientific journals have introduced fees for publishing materials on their websites to make them accessible to readers. Yet, the cost of publications on such sites sometimes reaches tens of thousands of dollars. For example, publishing an article in the prestigious medical journal The Lancet costs $6,500, while a paper in Nature costs $11,000.

DeSci As a Solution

DeSci is a solution to help scholars and scientists solve their funding issues. The DAOs that are already ample in number provide several options to scholars in need of financing (Wang et al., 2022). These options range from possible crowdfunding to NFT sales. Each smart contract has unique conditions that differ from project to project. These can be that part of the earnings made on the technology will be reinvested into the DAO later. Another example is raising funds for scientific projects - in theory, anyone with a rare disease could more easily participate in funding research to find a cure.

DeSci has the capacity to eliminate the intermediary between researchers and reviewers. Currently, scientists check the work of their colleagues for free, and the profit is fixed by an intermediary - some scientific communities or journals (Wang et al., 2022). Blockchain, with the help of smart contracts, will be able to eliminate the expensive middleman and connect scientists with reviewers around the world. This will make science faster.

The novel DeSci approach impartially checks the reputation of a scientist. The importance of scientists depends on the so-called h-index, which considers the number of publications and significant awards. This method is not flawed in itself but has disadvantages. In search of more funding, some scholars, instead of focusing on the quality of the publications, may resort to increasing the number of publications or re-publish previously published materials with small changes simply to increase their h-index. Publications for the sake of rankings are empty work that slows down science. DeSci activists propose to replace the NFT h-index, which will take into account not only the publications of the author but also other important work, such as expertise, educational success, mentorship, and participation in research of other scientists (Wang et al., 2022).

DeSci makes science genuinely open to the world and encourages scientists from all over the world to unite in teams of like-minded people, regardless of their origin and country's political situation. For example, in the form of online coworking and cloud labs. Such a limitless sharing of knowledge will drive progress (Wang et al., 2022). Scholars will be able to find solutions to problems much faster as this approach boosts progress and collaboration using the opportunities provided by NFTs and retaining authorship as required.

Blockchain technology for science

Blockchain technology (tokens, NFTs, metaversions) has the potential to positively impact the platform economy in ways that democratize access to scientific collaboration (Clincy and Shahriar, 2019). When you think of platforms, you usually think of Uber or Airbnb, which are world-changing projects in their own right. But platform economics is a very new area of research that even advances game theory as an academic discipline.

Decentralized Science (DeSci) differs from an IP platform or a platform where the more it is used, the more value the platform gets, and the value is consolidated. Speaking about DeSci, people who create value are researchers, scientists, citizen scientists, etc. – who receive value according to their contribution; those. The more other researchers, scientists, etc., use it, the more value they get (Ducrée et al., 2022).

The NFTs will play a significant role in the future of the metaverse, as it is through the NFTs that scientific research can be safely transmitted. For example, the University of California at Berkeley auctioned off an NFT tied to documents related to the world of Nobel laureate cancer researcher James Ellison for more than $50,000. The US Space Force, a division of the US military, has begun selling a series of NFTs featuring augmented reality satellites.

DeSci in action

The DeSci sphere in the spring of 2022 has just begun to develop. But in the future, blockchain will help scientists achieve the following goals (Ducrée et al., 2022):

unite scientists in a decentralized DAO community for collaboration;

move scientific knowledge from closed, centralized servers to the blockchain;

increase funding through cryptocurrency funds;

get rid of the influence of intermediaries in the face of publishing houses.

In 2021, the creation of DAOs became famous, thanks to which many scientific decentralized autonomous organizations have appeared. All of them are divided according to their areas of activity. DeSci DAOs may work to fund projects, create decentralized platforms for publishing and storing scientific papers, or conduct peer reviews of materials.

Organizations are also divided by scientific fields. For example, biotechnology and environmental protection are very popular in DeSci. These DAOs include VitaDAO, LabDAO, and SCINET. Individual scientists are also experimenting with blockchain and launching their research tokens (Ducrée et al., 2022). There are still many theoretical projects among DeSci platforms looking for ways to implement their ideas. But large organizations have already emerged that fund university research and launch their DAOs.

Funding initially comes to the DAO from sponsors. They can also sell the rights to research for this. Stakeholders create IP-NFTs (Ducrée et al., 2022). This token can be used as a currency and a factor in intellectual property transactions.

Also, some DeSci platforms may charge a small fee for publishing on their site. And the amount received is sent to the DeFi staking protocol, in which the coins bring profit as a percentage per annum, as in a bank deposit. Later, this profit is paid to scientists for participating in the platform's development (Cao, 2022).

The value of research is determined by the decentralized community of scientists who are part of the DAO (Wang et al., 2022). After receiving the results, the organization allocates assets for analysis and uses them for implementation outside the scientific community. After that, the DAO makes a profit and funds the investments into projects.

DeSci platforms are managed by DAOs - Decentralized Autonomous Organizations. In them, communities of scientists, researchers, and investors come together and make joint decisions by voting (Wang et al., 2022). The main goal of DeSci is to increase the participation of the scientific community in solving scientific problems and funding research.

Blockchain can solve the problem of access to information with DAO tokens. Membership in a decentralized scientific community gives you free access to reading materials on DeSci platforms. And one can publish research on them for free or a small fee.

In DeSci, bureaucracy is impossible - the DAO scientific community makes all decisions by voting (Wang et al., 2022). And thanks to the blockchain, the data remains online forever and will be available for study by any user. This helps protect research from outside influence and censorship.

Reputation check. The reputation of scientists depends on the h-index - an indicator that evaluates a scientist's number of publications and citations. The chances of obtaining government or private funds also rely on it.

With blockchain, reputation can be written into NFTs. They will store information about the scientist and his research. NFTs will become a verifiable reputation guarantor. These tokens will be available for research, peer review, training, mentoring, and open data exchange.

When citing a scientific work, researchers need to mention the NFT that is linked to this work. And users of the DeSci platform will be able to rate a publication using its token (Wang et al., 2022). This way, you can track the benefits of the study. Thanks to the NFT, the scientific community will decide whether to trust the scientist and the DAO - whether it is possible to issue funding.

Getting funding. Scholars now spend up to half their time writing applications and interviewing for grants. Whether they receive funding or not depends on the h-index and the subjective assessment of the commission. Reviewers examine how many publications and citations a scientist has and decide if they can be trusted.

However, this does not always consider the quality of articles, as the subjective assessment of the reviewers determines the potential of research. Because of this, young scientists have low chances of receiving financial grants because most prefer to invest in scholars who have already established themselves within the scientific community. This results in scholars writing many small papers with little input into their expertise. This phenomenon is called a funding crisis.

DeSci offers scientists to receive a share for participation in the research and development of the platform using DAO tokens. Each will be rewarded based on the level of input and contribution that one has made. At the same time, research funding can be obtained from decentralized funds. A scientist who applies to the DAO and the community jointly decides by voting on the research potential and efficacy of the experiment using the available means (Ducrée et al., 2022).

Validation of studies. In the scientific community, there is such a problem as the reproducibility crisis. A large number of investigations after their publication in scientific journals are tried to be repeated by independent researchers. As a result, many scientific discoveries are not confirmed. But they are still positioned as accurate for a long time, even after discovering the impossibility of reproducing them.

Studies have shown that articles with questionable results in leading journals are the most cited. Discoveries that cannot be confirmed in repeated experiments are cited 153 times more often (Wang et al., 2022). This happens because the editors of scientific journals are less demanding on such research.

DeSci can solve this problem by creating standards for publishing and storing research (Wang et al., 2022). Introducing proof of existing technology will help the scientific community avoid dubious publications. DeSci invites members of the Scholars blockchain network to validate content before publication in the same way miners validate transactions on the blockchain.

The element of gamification is also important. Gamification exploits people's natural tendencies to compete, collaborate, and achieve. This technique motivates you to achieve goals and increase productivity. Involvement tools can be levels to be overcome, rewards, and ratings. It is worth distinguishing between gamification and game learning. Adam Gazzaley has noted that implementing gamification principles is ultimately required as they constantly challenge the individual (Gazzaely & Nobre, 2012). When people succeed, progress must be harder to achieve, yet things ought to become more accessible when the latter are frustrated. Such an approach will keep the people involved (Gazzaely & Nobre, 2012). Gamification allows for the maintenance of an immersive environment facilitating imagery and constant progress of the people. Yet, most importantly, people enjoy their activities and have fun.

The gaming approach is learning within a specific game, and gamification is the application of gaming techniques in everyday processes to increase motivation (Gazzaely & Nobre, 2012). The idea of such an approach appeared long ago but is gaining popularity only now, as the old motivation systems gradually stop working.

Any game contains motivation for the participants. This is necessary, so that the player does not game at any of the stages. One must have a specific goal that moves one forward (Sailer & Hommer, 2020). Gamification naturally inherits this principle. After passing the level, the character is credited with gold coins, awards, and virtual diamonds in many games—the more complex the level, the more rewards (Sailer & Hommer, 2020). The reward is one of the critical principles of gamification. Such “carrots” as employee salaries or positive grades for students gradually stop working. A person knows that the result will be the same if he does his task well or very well. Additional reward motivates one to act faster and better,

providing additional interest (Sanchez et al., 2020). A bonus to salary or exemption from one homework for the best student will help increase motivation. In marketing, this can be accumulative points from each purchase on the card.
Considering all the above, the technology we seek to develop will utilize the Blockchain to host the Science whereas the deliberation of researchers and scientists will be achieved through decentralization of hosting and creating a norm where reviewers community is easier to approach and thus eliminating barriers of entry and non-justified costs associated. This technology manifest as the concept of "Virtual University".

Virtual University – Model Structure

The proposed university herein acts as a virtual market linking three entities: the problem givers, problem solvers, and the problem sponsors. A problem giver can be a university professor, or scientists or a company looking for manpower to research a specific problem or idea. A problem solver is the student who seek to solve these problems in order to earn "Uwork" coloured credits exchangeable to the sought degree. Finally, problem sponsors are the crowd of people/entities which are interested in using the solution of a problem operated via crowd funding mechanisms. Figure 1 present the overall structure of the model.

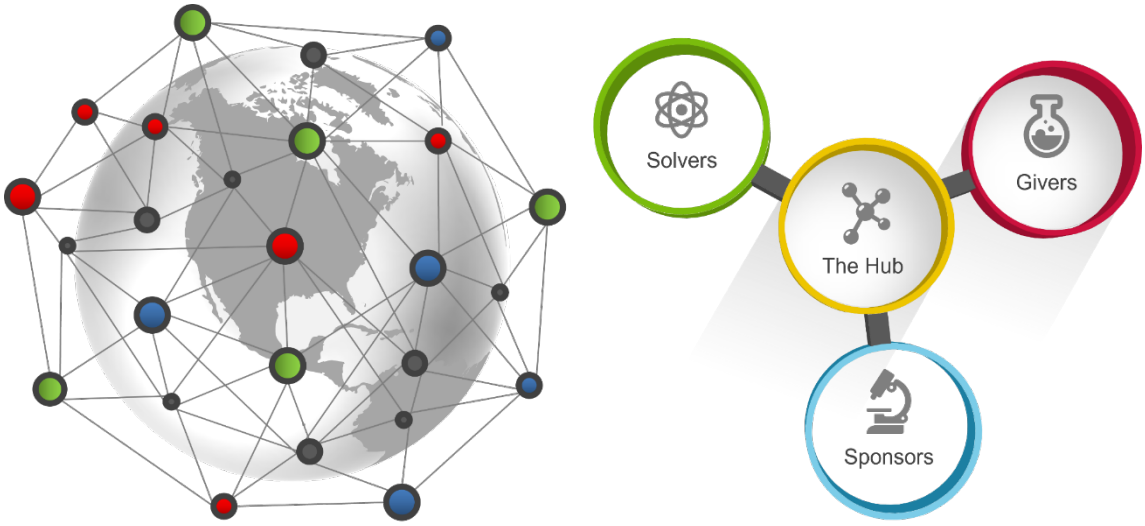

Figure 1. Depiction of the Virtual University decentralized approach

Problem Solvers

Problem solvers i.e., students can enrol in the university by submitting their standard documentation: a transcript showing completion of a relevant B. Sc. degree, a resume and payment of the membership fees. The membership fee is a periodic fee of very low value to encourage enrolment. Enrolled problem solvers will gain access to: i) online lectures, ii) access to a high-performance cluster, iii) access to cloud-based tools, iv) access to the pool of problems that can be solved for "Uwork" credits. By solving problems, the solver can gain "Uwork" coloured credits which can be exchanged for the targeted degree. Moreover, higher gained "Uwork" coloured credits reflects higher trust and reputation of the solver. The colour signifies the science to which the solved problem belongs to.

Problem Givers

Problem givers i.e., professors / employees of corporations can enrol in the university by submitting a resume and the payment of the membership fee which can be waived by submitting video lectures. Problem givers gain access to: i) online lectures, ii) high performance computing, and iii) access to cloud-based tools, iv) submission of problems via the Hub. Problem givers can decide to publish their solutions in the periodic University journal.

Problem Sponsors

Problem sponsors i.e., commercial, crowds or philanthropic entities can enrol in the university by submitting a profile and membership fee which can be waived if the entity offer sufficient dedicated cloud-based resources to the university. A problem sponsor is entitled using the solutions of the fully sponsored problems in a non-exclusive irrevocable license. Moreover, a problem sponsor can have access to the problem solver resumes and their gained "Uwork" credits.

The Hub

The hub is where problems are posted by problem givers operating under the DeSci framework. The problem consists of the problem giver, the problem description, the proposed "Uwork" credits. Each problem is assigned a "Uwork" credits based on its difficulty. The "Uwork" credits has a colour signifying the type of science the problem pertains to. The assigned "Uwork" credits can increase or decrease by the sponsors by voting. Each vote costs a minor fee. A sponsor can decide to sponsor the problem completely thus blocking all other sponsors from accessing the problem solution for a larger fee.

The paid fees for all cases are split between the University, the problem givers and the problem solvers (once the problem is considered solved). Higher "Uwork" credits problems are always prioritized in the hub. Problem solvers can express interest in solving a problem. Once they express their interest their resume will be available for the problem givers to review along with their gathered "Uwork" credits. Solvers with higher "Uwork" credits are prioritized in display by the hub. The problem giver can assign one or more solvers to the problem. The problem giver and the problem sponsor (if sponsored completely) decide if the problem is solved. Once solved, the assigned "Uwork" credits will be given to the solvers.

The solution of non-fully sponsored problems can be peer-reviewed by other problem givers and sponsors and assigned a proposed "Uindex" value. Higher "Uindex" values equate to a higher reputability solution that is recommended for publication in the University journal.

The Hub Ledger

The hub ledger which consists of the problems, their “Uwork” credits value, and the “Uwork” transactions are managed by a blockchain system which generates “UCU” as a cryptocurrency. All members can be part of the blockchain and mine UCUs. UCUs can be used as an accepted currency by the university in paying its fees.

Graduation

A problem solver can exchange their "Uwork" coloured credits for University degrees such as Masters and PhDs. Gained degrees will be displayed in the resume of the solvers.

University Financials

The university revenue comes from: membership fees and UCU exchange market. The fees are used to pay the staff that manage the hub, the hub server's fees (if cloud based). All the staff work from their respective locations (home or whatever) and are paid from the gathered fees. The University journal is open access.

Why to enrol?

High calibre problem solvers are driven by three factors to enrol in the university: 1) being virtual 2) revenue from solved problems, and 3) the degrees. Problem givers are driven by : 1) access to high calibre cheap solvers (solvers are paid once the problem is solved), 2) revenue from sponsors 3) fast solution to their problems. This system circumvents the need for applying for grants repetitively since once a problem is posted it remains in the Hub until fully sponsored and solved. Solutions with higher "Uindex" are recommended for publication in the periodic University journal. Problem Sponsors gain access to the problems and solutions of non-fully sponsored projects. Furthermore, problem solvers are only paid for their solutions hence reducing the cost of manpower for the sponsors. Finally, the sponsors can block other sponsors from accessing a solution if they want to utilize it for a commercial interest.

C. Conclusion

DeSci is a step forward in developing general science and gamification. It has ample advantages that help scholars and scientists fund their research attracting investors from the most unforeseen spheres and industries. Utilizing blockchain advancement, DeSci makes the sphere of science as transparent as possible, helping the progress of technology and humanity in general. The Virtual University model we proposed herein relies on the elements of DeSci and the aspect of gamification to push forward a working model that is accessible to the crowds thus democratize the generation and dissemination of Science.

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