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DECENTRALIZED AUTONOMOUS ORGANIZATIONS AS THE NEW FORM OF ECONOMIC COOPERATION IN DIGITAL WORLD

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Abstract:
This paper draws the concept of the decentralized autonomous organizations (DAO) as new opportunities for digital economy and new form of digital cooperation with economic potential of DAO, as well as reveals the main problems and risks associated with functioning of DAO. Quick development of technology and digitalization of society, increase in the number of modern electronic devices will lead to new forms of cooperation, where borders and distances will not be an obstacle to combining human efforts and resources. One of the forms of such cooperation should be DAO as a reliable and effective substitute for the institution of economic mediation and traditional legal forms. Despite the attractive optimization of a number of processes due to digital freedom and low bureaucracy, a number of issues related to protocol security, legal uncertainty and temporary complexity of the internal mechanism remain unresolved.
Modern technology based on blockchain represents the opportunities for capital formation with new organizational form as DAO, where transferred digital assets and cryptocurrencies can be administrated by internal governance structure or with participation of another compatible DAO. . That allows the creation of organizations where the governance is based on formalized rules and direct real-time control on funds with the processes are automated using software. Experiments with DAOs have been going on for over six years and are accompanied by discussions about their automated structure and mechanisms for capital accumulation. It is believed that future opportunities will lie in the formation of new types of organizations based on digital interaction of stakeholder s and decentralized governance. Despite the potential of such form of cooperation, there are unresolved problems of legislative regulation, security and governance.
We are convinced that new forms of economic cooperation based on blockchain and DAO technologies may open up shortcomings in the near future, and we know how to implement them in national platforms adapted to modern legislation that promotes economic progress and global cooperation. Also we believe that DAO should become a separate economic system based on the idea of Seconomics end Robonomics, where the digital economy is seen as an integral part of CyberSecurity.

Key words: Covid-19, Enterprise, Decentralization, Decentralized Autonomous Corporations, Decentralized Autonomous Organizations, DAO, blockchain.

JEL classification: L86, M21, O17, O30, P20, P33, C60

1. INTRODUCTION

Unique boom in innovation in the blockchain technology based on Bitcoin actually is recognized by governments, major financial institutions, as well as national central banks. Digital opportunities will undoubtedly expand beyond the world of finance, and practical implementations of concepts of digital cooperation combined with new technical solutions will allow creation of the new economic forms also based on smart contracts and DAO. Technology capabilities of blockchain that can give new potentials to the economy as optimal administration of transactions, including automatic register and control, lack of intermediaries and bureaucratic procedures, instant execution of operations, as well as capabilities to work with digital data, lead to a new type of economic cooperation as the part of the digital economy. The combination of several smart

contracts, as the structural part of the DAO, can even replicate certain business functions of a company maintained on a blockchain. Such new form of sociality that emerges would be transparent, efficient, fair, and democratic. The examples of such cooperation with the use of DAO could be a project for determining the optimal solution in commercial projects based on expert probabilities, and different types of information gathering and processing models. As changes in the structure of relations during the Covid-19 crisis have shown, remote forms of cooperation are most rational when economic relations are forced to comply with a number of restrictions related to closing borders, reducing personal contacts, but with technical solutions with high degree of confidentiality and trust. It seems strange that political and social crises, including those caused by political contradictions, a poor information system, or an outdated legal system, do not use an accessible form of government as a digital voting model. Developed digital models based on the obtained data, including using the concept of Game Theory, could become the basis of a new model of the digital economy with enhanced protection of personal data. A simple example is the model of rewarding independent musicians for creating works and encouraging their creative behavior [17]. It is believed that such a model of encouragement could have a positive effect on human behavior during the Covid-crisis.

According to some scientists, the first DAO was Bitcoin, running by consensus from all network participants for changes in the code to be made and without a central authority. But the first real experiment with decentralized governance, called as The DAO and build on Ethereum, not so successful as Bitcoin, attempted to utilize algorithmic authority through cryptocurrency and blockchain technologies to create a real social and economic structure quite unlike anything we have seen before. Governance rules programmed by smart contracts represent new forms of social and economic interactions based on a decentralized, enforceable, potentially unstoppable and publicly available blockchain. From across the globe at first time this digital structure collected as investments over $168 million, making it the most successful crowdfunded venture ever. Following collapse of The DAO new interest in such solutions is raised. Thus, actually such form of digital cooperation has a huge potential for economic growth, making the programming code useful for anything that can be expressed in the programming language for social and corporate infrastructure. Performing the transaction launches independently by any third party executing the code may establish certain conditions where participants are quite independent in theirs cooperation intentions.

As many developers and scientists assume, the economic infrastructure in the Internet will be complemented by solutions based on open protocols such as Bitcoin, where many digital services will be provided through the DAO. In the other hand, it is believed that modern blockchain platforms are a digital swamp, wasting resources for the sake of speculators and are financial bubbles. It is necessary to apply such technology for the purposes of society, primarily the optimization of business processes. Convenient, transparent and independent use will make it possible to unite specialists and organizations around the world, regardless of borders and distances, for any possible economic reason. Each DAO should be structured according to the internal goals that are being set.

DAOs and smart contracts are considering as the next stage in evolution of the Internet as the new form of communication and business forms based on blockchain technologies with entirely different nature that traditional form of organizations. Their potential impact on economic and social relations can be assessed as high for the reason that economic value is based on data transmission with high level of security. The technology of blockchain uses digital signatures based on cryptography with public and private types of keys that provides privacy, but at the same time retains the ability to verify the reality of transactions.

Decentralized register with new styles of digital interaction can reliably automate business interactions reducing operating costs and simplifying business processes without any central control. Increase in the number of devices in the future and exchange of big amount of data require less complicated and cheaper solutions. Data and signals from real world could feed the blockchain network interim smart contracts making Blockchain as a base for cooperation in digital economy,

primarily market of things. Distributed architecture of communications represents new opportunities for exchange of resources and values in the digital economy without corruption, forgery or manipulation, which should encourage cooperation and rise of digital trust without intervention of third party. Open standards, protocols and licensing models of decentralized solutions will contribute to the further increase of decentralized economic infrastructure.

The growing amount of information with incubated code and privacy between the parties should support transactions in monetary or non-monetary type of assets that represent some importance for business where specific components such as consensus mechanism, role management, and network access administration require a level of modularity, scalability, and expandability. That provides flexibility without changes in the basic source code. Over decentralized network content and ideas can be exchanged largely without intermediaries using a potential of blockchain technology with impact to the future of business models, as well as social and economic structures and in a manner comparable to the impact of the Internet. Huge potential of blockchain technology that may lead to the development of digital economy is obvious. On the other hand, new technologies will have a great impact on traditional model of economic intermediation [5].

2. DEFINITION OF DECENTRALIZED AUTONOMOUS ORGANIZATIONS

Recently, several attempts have been made to interpret the concept of DAO for different purposes and for different areas of activity. In technical terms deserves attention the understanding of DAO as an organization where organizational logic and the rules of operation are encoded in a form of smart contracts [6]. This understanding of DAO more reveals the technical structure but does not provide the characteristics necessary for its understanding as an economic entity. In order to give an economic interpretation, we consider some more definitions provided by various scientists.

- "DAO at its core is a simplistic organizational structure and governance process that allows for the collective management of common goods which can be economic or non-economic" [2].
- "DAO is decentralized entity such as corporations and institutions running entirely autonomously and decentralized on a blockchain, where important management decisions are made by logic defined in code, executed by smart contracts and finally, through automation of decision-making, creating value for customers" [3]
- "DAO is a special form of smart contract that can perform various functions traditionally performed by institutions like companies, foundations, associations or cooperatives, created for economic purposes" [5].
- "DAO is a smart contract taking the form of organization of an undertaking by a group of people (and may be open to new members)" [5].
- "DAO is an organization that uses software rules to execute organizational routines, plus votes from some class of members to alter and extend those routines. No direct management is required. In Bitcoin, the miners are the voters, but this is not strictly necessary" [7].
- "DAO is a pseudo-legal organization run by an assemblage of human and "robot" participants. The robotic participants are algorithmic rules that run on the distributed Ethereum blockchain, and automatically respond to inputs according to programmed rules" [8].
- "DAO is an organization that is run through rules encoded as computer programs called as smart contracts. A DAO's financial transaction record and programmed rules are maintained on a blockchain, which ostensibly increases transparency dramatically at the expense of security" [16].

In addition to these definitions, DAO is also described as "an innovation in the design of organizations, in its emphasis on computerized rules and contracts in an age of blockchain technology and decentralized structures, where the DAO's structures and functions also raise issues of governance" [16]. DAO organizational-type is difficult to describe structure without precise legal status and requires academic and practitioner attention.

In addition, there is also an understanding of similarly to DAO structured decentralized organizations as Decentralized Autonomous Corporations (DAC), as a structure with purpose is to make a profit. DAC is a form of new and innovative corporate structures enabling new venture ideas become established and incorporated into business entities. Such autonomously running structure has a specific goal to generate revenues. In more detail, a DAC is a digital company existing in the cloud, performing valuable functions for its participants. Clients of such DAC are automatically pay the services they receive. All operations performed by this structure are accomplished by the code. Internal business logic of the DAC represented by the algorithm and over the blockchain [4]. Interactions with organizations or individuals are caring out using more or less complicated smart contracts dealing with some sort of property.

It should be noted that blockchain technology is primarily a distributed data ledger, where the record is performed making certain operations through the execution of program code, referred to as a smart contract. For economic reasons we will try to give our own definition of DAO, which would allow a clear understanding of its structure and economic purposes for which it is created, as well as the functions of implementation based on existing understandings and functional features of DAO. To this end, it is necessary to reconsider some features of DAO, which are important in economic terms. After summarizing, we have identified the following economic characteristics of a DAO:

- Decentralization: is composed of smart contracts built on decentralized infrastructure and governed by encoded rules are executed automatically and existing on decentralized infrastructure.
- Independence: cannot be influenced by external forces and acts independently. Any physical interaction is not needed to enforce partnerships because a smart contract runs on nodes automatically and does not require any human interaction.
- Autonomy: non-centrally controlled decision making and governance: is an entity that acts independently without external forces.
- Automatization: its operations are executed automatically through execution of the program code.
- Intelligence: includes the mechanism that can change the rules of operation:
- Transparency: its open-source code and organization are fully transparent and incorruptible that provides transparent decision-making process.
- Omnipresence: can operate worldwide in a decentralized manner without local incorporation and national location.
- Digital form: its organizational logic and operational rules are encoded in the form of smart contracts in a blockchain that can be easily set up as a global open to anyone organization operating using computer codes.
- Permanence: its rules are resistant to direct attacks and cannot be easily changed. If possible upgrade of the rules is provided by the code DAO can automatically initiate changes in an irreversible way and written into an immutable distributed ledger.
- Auditability: every ledger is retraceable across its full history, verifiable and accountable.
- Interoperability: can automatically respond to input operations in accordance with programmed rules, as well as using fully autonomous sensors.
- Anonymity: its participants have pseudonymous or anonymous access without disclosing real names and can transact without revealing theirs full identities.

DAOs are also currently formulated as a combination of a digital corporation and a real-world using organizational structures and based on blockchain technology, with some features of a legal entity and governance, where autonomous and decentralized elements give the opportunity to automate organizational structure with elements of voting, governance, asset distribution, incentives, etc [3]. DAO allows significant savings on legal costs, including in the process of creating legal rules and legal regulation of DAO, taking into account the high degree of transparency and automatic execution of operations.

Thus, from economic point, DAO can be scribed as a decentralized corporate ledger (created for the purpose of financial and / or technical cooperation, such as corporations and institutions)

running entirely autonomously and decentralized due to the technology of blockchain, where all or most management decisions are made by smart contracts through a logic written in code.

The internal corporate structure and rules of DAO in the form of program code that meet the goals set by the developers, may determine the set of internal instruments, which can often be the following:

- Emission of transaction tokens: DAO can contain a valuable property in form of tokens used for rewards the investors or shareholders with the voting power, and structured for relationships between its participants.
- Structured consensus: decisions of stakeholders to be made should be agreed (funds withdrawing, optimization, process of decision-making, etc).
- Contract opportunities: DAO can independently accomplish several tasks as hire manufacturers, purchase data or digital assets in order to reach business goals, according to shareholders' decisions.
- Proposals functions: DAO to fulfill their goals may provide the proposals as the part of decision-making process that could require execution of several conditions or monetary deposit.
- Voting process: organizational structure can implement the procedure for voting for decision-making as code repairing, capital raising, investing, that can only take place if a necessary number of votes is reached.
- Data inputs and outputs: allow to receive information from external sensors or unsynchronized external databases, as well as data output for receiving them by identical systems.
- Record keeping - sorting and regularly compiling of transaction data.

In addition to mentioned features, it should be noted that DAO could contain repetitive and simple tasks, that can be automated, as well as tasks requiring human engagements and creative thinking as innovation, responsibility or expertise [3, 9].

3. TECHNICAL STRUCTURE OF DAO (SMART CONTRACTS)

Before moving on to considering DAO as a form of cooperation and comparison with traditional forms of organizations, we consider it necessary to briefly consider the technical structure of DAO. Creation of a DAO requires human decision-making intervention to map out automation of the processes, to validate the need, identify the opportunities, find co-collaborators, etc. In addition DAO can have multiple off-chain operational requirements relying on human action, such as management function or board, arbitration, team communication, governance, contracting. Such functions require accountability to ensure the tasks and communication tools to control that expectations of participants are being fulfilled.

As the technical definition of the DAO indicates, the rules of organizational logic and operation of DAO are encoded in the form of smart contract, as a set of promises, specified in a digital form, including protocols within which the parties perform on these promises. The smart contract itself in the form of a program code and the results of calculations are recorded in an immutable distributed ledger. Thus, the recording of computations and the execution of a smart-contract are done in a decentralized, open manner, while maintaining the anonymity of the participants. Where smart contract is automated computer programs that enable the terms of a contract to execute upon the occurrence of some event, without external intervention. In the case of DAO, the usual charter of a company turns into a set of rules written in a programming language in the form of a smart contract, where all rules are automatically executed if all the conditions for data collection are met. A smart contract is executed as a program in a given blockchain, executed by distributed nodes of the network and recorded in the blockchain. That eliminates the need for intermediaries or a trusted third party. Influence on the operation or modification of the smart contract requires consensus of essential part of the network.

The terms of a smart contract translated into code and uploaded in a blockchain are accessible to everyone. When pre-programmed conditions are satisfied the contract executes automatically, that eliminates the need for a third party. Using smart contracts the parties can agree

to the set unbreakable terms that allow to enabling parties who do not know one another to arrange cooperation without fear of breach and with high probability of the execution of the terms [2]. Such structure allows remove human from certain processes as intermediary. The parties are free to adjust terms whether by vote or through the occurrence of pre-programmed triggers. Thus, contractual terms of smart contracts are more precise and potentially less ambiguous and allow parties to enter into anonymous transactions without fear of breach. Written in code smart contract can be tested before execution in contrast with traditional contract, and doesn't need for human intervention to enforce its performance.

Data to perform a smart contract can be provided by the parties, or pulled from the real world through oracles (data loggers from the outside world) developed to monitor and verify certain type of data or the real-world events and facts.

At a conceptual level, internal structure of DAO, as a set of smart contracts functioning independently in cyberspace, has the following characteristics:

- Legal relationship can be concluded without traditional signatures and paper documents or by electronic means;
- Automatic performance of the terms accordingly to the rules set up in the smart contract;
- Conclusion and performance are independent from any third party;
- Can be used for any legal relationship, including organization structure, voting system, public register, etc.;
- Can be used to build complicated structures, such as financial and trading platforms, corporate digital forms, digital banks and digital innovation hubs.

4. DAO AS A NEW FORM OF DIGITAL COOPERATION

The first corporate form emerged in Ancient Rome and privileged by the State got its global extension to profit-oriented companies starting from the 17th century [10]. The first modern corporation appeared in the United States and granted the power to form corporate structures after going through extensive approval process. Since then, organizational corporate forms and their structure have not changed much. Adapted in the legislation of different countries, companies and organizations are guaranteed by local law, the rights of participants for the purpose of cooperation are protected as the rights of the parties in the corporate contract. In contrast to traditional corporate forms, the activities of decentralized organizations are primarily supported by the implementation of program code, which indicates the transition to more advanced corporate mechanisms.

The main different feature of a DAO comparing to traditional organizations is the rules set up as immutable computer program. Such rules cannot be easily changed and are resistant to direct attacks. Owned by an individual or stakeholders traditional organization are registered by the governments in a centralized manner, managed as an hierarchical structures with control over its activity from the State. Shareholders with direction decide how to manage organization and remaining participants just follow such decision. In a DAO all relations between the participants should be coded with digital execution and following registration of the corresponding changes in the ledger, thus, the decisions are executed without any manual intervention.

By its internal structure, DAO is a computer program running on a peer-to-peer network on a blockchain where users interact according to programmed protocol. a Decentralized management structure of DAO eliminate the board of directors in contrast to the structure of traditional corporation. Numerous classes of participants as shareholders, board of directors, managers, employees and other participate in the corporate hierarchy in accordance with a set of bylaws determining decision making and hiring procedures. As for DAO, it involves a set of users making decisions and interacting with each other according to protocol in blockchain and maintaining the records of each participants and allows to vote on various items through the blockchain in decentralized manner[2].

The economic structure of the DAO, due to its autonomy and decentralization, is essentially limited by the author's imagination; any managerial forms and models can be embodied and

connected, including models of fuzzy logic, real options, game theory and contract theory. Thus, the capabilities of DAO make it possible to create the most bizarre and unusual forms of interaction, including creation of creative and technical associations across worldwide. During work on The DAO it was proposed to address to the game theory as technical fixes for digital technical attacks [8].

All kinds of corporate entities are governed by written rules that describe organizational logic. Such rules may exist in the form of private contracts set up in bylaws or shareholder agreements between corporate owners, a management options contract with management, employment contracts with staff, and a service agreement with experts and consultants. In the same manner, governments could improve public confidence by transferring their data tracking processes to publicly viewable blockchains. Blockchain-powered data and asset management solutions make administration of economic law regimes more efficient.

Blockchain technologies have all necessary capabilities to building an inclusive global digital economy with high level of auditability and transparency. Actually the role to ensure an order in economic cooperation belongs to the governments.

Blockchain, with its structure providing high level of trust at participants of relations, can ensure cheap exchange of values across borders and the global economic cooperation without the need for an intermediary such as bank, brokers, or exchanges [11].

The role of the integrating mechanism of global exchange of information should belong to DAO, as a code of rules for digital cooperation, where peer-to-peer transactions are integrated with Internet of Value and emerging technologies such as cloud computing, artificial intelligence, augmented reality, big data, robotics, additive manufacturing, nanotechnology, new materials and biotechnology.

System of DAOs with ability to record, broadcast and verify transactions in a transparent manner can also strengthen global financial system in real time obtaining the risk-monitoring data. The following directions are defined as priorities for private sector development:

- Financial services as micro-finance, micro-savings, remittances, community investment initiatives, insurance, etc;
- Internet of things (IoT) and Internet of Value;
- Global supply chain integration for Small and medium-sized enterprises including trade finance, customs compliance, data tracking, etc.;
- Financing of projects on clean energy and social oriented start-ups;
- Digital identity and consumer privacy management services;
- Blockchain-based prediction markets and gambling;
- Oraculs and notary services with optimization of data inputs;
- Digital universities and education, qualification of professional ratings;
- Conflict resolution and arbitration with system of experts.

The projects with mentioned direction of activity can be deployed in the form of DAO. Data interchange and DAO interoperability can be achieved through the same software platform, as in the case of Ethereum, as well as by standardizing the information inputs and outputs of the DAOs.

In the real world, the structure of companies depends on the legislation and economic opportunities provided by the local economic system. The forms of economic cooperation using DAO can be very diverse, from a simple pooling of capital with its subsequent distribution when certain circumstances occur, to cooperation of groups of developers of innovative products, in order to create and promote this product on the market. We assume that the main work of human resources will be reduced to provision of digital data and proposal of digital models for effective operation of DAO or assessment of results.

In a digital environment, the success of a DAO depends on reliable, validated, timely and accurate digital information. Verification and provision of such data can be performed by individual DAOs, including using real experts, who in turn can be hired by such DAO themselves, or upon reaching a consensus of participants or management. Also, individual DAOs, using certified specialists, can encrypt personal information, which is necessary to perform expert functions,

confirm qualifications, assign the necessary ratings, as well as ensure the requirements of the legislation on the disclosure of personal information in order to control the licensing activities of participants and ensure tax collection. Thus, an entire infrastructure can be built, consisting of digital banks, exchanges, developers and expert groups, providing digital interaction of the DAOs with individuals granting digital content to such a system.

In the case of the necessary physical execution of digital solutions in the DAO system, for example, in the case of seizure of property, conversion of digital currencies into fiat currencies, such operations can be performed by hybrid structures operating under national legislation. Such structures can be banks, notaries, relevant departments in government agencies, etc. Obviously it is impossible without the national legal regulation of this kind of activity

5. PROBLEMS OF DAO

Despite the potential of DAO, a number of problems remain unresolved in order to accelerate the widespread use of this form of cooperation. First of all, we mean a number of technical shortcomings of modern DAO, which is often mentioned the first DAO under the same name The DAO, launched in 2016 by Slock.it on the decentralized platform Ethereum, and related technical problems.

Within the static funding period of The DAO, eight possible security risks was outlined, all concerned game theory issues, rather than possible code bugs. After launch of The DAO its code was exploited by an unknown individual using unintended behavior of the program logic and stealing the fund in ETH tokens in equivalent of millions of dollars [9]. Thus, the example of The DAO showed that a defective smart contract can occur to unforeseen consequences. Consequently, even if it was designed accordingly to the parties' intentions, any change in circumstances may lead to change the rules of play. However, if necessary, a solution that allows escaping unscathed from the smart contract can be added into code [5].

The potential risk of theft in DAO's assets through a change in governance and ownership rules represent a major concern. An attacker who owns 51% of the tokens purchased during any period can make a proposal to transfer all assets to himself. Due to the actual ownership of majority of the tokens, and, accordingly, having the rights to confirm the operation, they will be able to pass their proposals [1]. Thus, it is necessary to take measures against usurpation in one center of control of the critical share in the DAO, which could potentially jeopardize the technical safety of participants.

DAO, as a sat of smart contracts executing automatically, once has been created anybody cannot change its rules, if such possibility has not been programmed in advance. That feature represents another technical risk related to flexibility. Due to extraordinary change in circumstances, the participants acting through a trusted third party or together should be able to modify original arrangements and adapt the code to new circumstances [5]. The programing code could also include bugs, or incompatibility of the code with an evolution of DAO. It is not easy to digitalize human decision-making with all complexity of rules writing as code, that in unforeseen situations cannot be quickly be changed. The solution of such problems should be significantly simplified after the emergence of the patterns and standardized DAOs, which will perform homogeneous functions. Either way, The DAO introduced and explored an interesting technology for experimenting with new models of society and governance issues.

DAO, as a new organizational form should have the legal status that is important for a number of reasons. Without legal recognition there is no formal and open procedure of investment into DAO, and the investors are not protected under corporate laws. In addition, a partnership interest in DAO is considered as a security under securities laws of several countries, thus the offering of such partnership can be a subject of state registration procedure.

The lack of authorities of a DAO due to technical features and the inability to ascribe legal capacity to a DAO represent a risk of liability for unlawful actions carried out through the DAO. With legal outlook on DAO we are considering the possibility of some progress in the legal

regulation of DAOs as part of the infrastructure of blockchain technology, both nationally and internationally. At the same time, one should take into account the characteristics of the DAO that affect its recognition and control by regulatory authorities, namely:

- Autonomous character of DAO, where certain actions of legal relevance occur automatically executing the code;
- Abstract nature of DAO existing in cyberspace in the form of algorithms. Its correct operation in cyberspace doesn't require any traditional legal structures;
- Global character of DAO and lack of reference to a specific place to determine its jurisdiction. DAO functioning in a distributed network without any central devises and cannot be assigned to traditional location of the company;
- No central responsible entity, person or central authorities representing the DAO, that make difficult to identify responsibility for operation. Is considered that the responsibility of the coders developing the code of the DAO is limited, because after deploying the code they lose the control and DAO is starting to exist independently;
- No legal personality of DAO as well as legal qualification of the actions when DAO has to interact with external counterparties. From a legal perspective DAO is a form of cooperation between all of its participants, thus, such form of organization can be considered as a new form of legal entities.
- No legal and judicial capacity of DAO as a party to judicial proceedings, that causes practical difficulties in interpretation of legal interaction with a DAO, even necessary relations for its effective functioning, including relations with programmers developing the code for the DAO or oracles or other structures providing information for DAO.
- Legal uncertainty with the decentralized nature of DA and, difficulty with jurisdiction determination that represents a legal risk and major barrier faced by entities involved in creating DAO.
- Difficulties with withholding taxes and unclear status of DAO for purposes of tax law. It's believed that legislative intervention in the area of tax could expose a threat of an absence of appropriate legal regulations. General tax interpretations of a DAO transaction would not only help with the correct calculation and collection of taxes from persons or entities participating in DAO, but could also provide an opportunity to determine the taxation regime for foreign participants.

Resolving the issue of legal regulation of DAOs and smart contracts with rethinking of law application will lead business cooperation to the domain of algorithms. Legal regulation on blockchain technologies will require correspondent skills on computer code interpretation and translation. Law on blockchain making process and its application will require close cooperation between the legal and IT communities.

6. OPTIONS FOR DEVELOPMENT AND SOLUTION OF THE PROBLEMS

Using official DAO platforms registered and created in accordance with the legislation, DAOs can be created as traditional legal entities and can use digital or binding legal agreements to perform the tasks, effectuate the transfer of assets or organize its internal structure.

A modeled platform for DAO activities should take into account the need for a high level of security, both the platform itself and the security of the participant when choosing commercial options. At the same time, rewarding participants in ensuring safety could be expressed by an equation on optimal adversarial strategy for selfish mining and participation in DAO.

Typically, at the legal level, DAOs use the LLC legal form to operate within legal requirements to provide some kind of legal protection to DAOs and their participants. Due to the need to regulate the activities of DAOs, regulator can create obligations for individual participants in order to tax and regulate the DAO participation liability.

The complete absence of legal regulation of DAO does not mean that internal or external interaction will not exert legal effects with certain consequences in the traditional legal sphere including contract law, tax and regulatory issues, copyrights, payment services, securities trading,

etc. Adaptation of the DAO platform to legal rules will make it possible to administer the created DAO in an automatic mode with automatic provision of complete information to the relevant authorities, as well as automatic withdrawing taxes. Blockchain provides the possibility to cooperate effectively and achieve consensus between parties unfamiliar to each other and conduct a transaction without services of intermediaries or a trusted third party.

For the purposes of control and taxation, it is very important ascertain the identity of the participants. Development of digital identification based on blockchain technology, which will allow carrying out transactions with a clear identification of the counterparty and its capacity.

Numerous legally recognized instruments for identification in the digital world can be used to achieve various legal consequences. Regulation of European parliament No 910/2014 2014 on electronic identification and trust services for electronic transactions in the internal market and repealing [12] provides the means of electronic identification for trust services such as electronic signatures. Due to new trust services the participants of DAO could sign legal documents using digital instruments with the same legal effect as a hand signed document.

The studies in the frame of European Parliamentary Research Service, namely Regulation on Blockchain and the General Data Protection Regulation [13] and European Parliament resolution of 3 October 2018 on distributed ledger technologies and blockchains: building trust through disintermediation, noted that blockchain and distributed ledger technology are a tool that empowers citizens' users to control their own data and decide what data can be used or disclosed. Also recent pilot regime for market in crypto-assets infrastructures based on distributed ledger technology [14][15], and numerous studies on digital futures and artificial intelligence, as well as innovation-friendly EU regulatory framework on financial services confirm the absence of obstacles to apply new technologies. The proposal, for a bespoke regime for crypto assets seeking to provide appropriate levels of consumer and investor protection, legal certainty for crypto-assets, enable innovative firms to make use of blockchain, distributed ledger technology and crypto-assets and ensure financial stability. Thus, regulator has been examining the challenges and opportunities to define the regulatory treatment of all crypto assets that are not covered by existing financial services legislation. Mentioned papers can serve for further work on the legal regulation of decentralized technologies in the framework of national and international law, including the development of principles and templates for DAOs as new forms of international cooperation.

Under the current conditions, several scenarios of legal regulation of DAO are considered. Mechanism for the introduction of legal regulation primarily provides for simple short-term solutions that needed to ensure tax and legal security, as well as defining the regulatory and tax consequences. Legally recognized traditional legal entities linking the traditional legal system and services on the blockchain can help in the first period to cope with the difficulties associated with the lack of legal personality of DAO through identification of its participants for commercial and tax purposes. Long-term solutions required understanding of the nature of DAO. Further growth in blockchain technology will require backing from the state with following scenarios. DAOs could be applied with fulfilment of certain criteria with clarification of their legal status that could mitigate the legal risk for creators and participants under tax and criminal law. Thus new technical solutions should be expected enabling state intervention in DAO and smart con-tracts. The states could recognize the legal personality of DAO subject to deployed in standardized DAO enabling state intervention in the code of DAO. Such solutions contradict to the nature of blockchain with unique opportunity to create digital economy free from state control and intermediaries. Such strategy represents possible direction enabling further development of blockchain technologies and DAO [5].

As a new form of combining investment and employment, DAO enables participants to independently develop smart contracts and implement them in DAO by joint decision with other participants. As part of this work, new areas of digital investment can be developed and models of digital management and development of investment and technical solutions can be improved. It is assumed that digital freedom and technical simplicity will allow the use of digital models and

financial instruments such as real options, fuzzy logic, game theory, contract theory, neural networks and others.

CONCLUSIONS AND FUTURE WORK

Blockchain technology with smart contracts and DAO constitute an opportunity for the global and regional economies taking into account incredibly dynamic technological progress. We are currently at an early stage of technology development and the next stage may be the leadership of technology developed countries in blockchain-based innovations. Support of the States and international organizations is also needed for research and for innovative enterprises.

The study of DAO is an interdisciplinary science and covers economics, finance, law, IT and mathematical modeling. The result should be a balance between the technical capabilities of blockchain technology, societal needs and the legal regulation of new digital associations. The digital structure of DAO makes it possible to directly apply mathematical models, which increases the usefulness and accuracy of the latter.

Smart contracts and DAO offer an example of the attempt to extend digital technologies to further areas of life, even more, create the basis for global cooperation without borders.

It is obvious that actually there is no mechanism for monitoring the activities of DAO by the state. In our opinion, the combination of the functions of the state-crypto-security-economy will provide a basis for creating a decentralized national economic platform capable of providing a cheap mechanism for administering the state economy, while giving all segments of society the opportunity to exercise their rights. Only such a mechanism is possible for the implementation of the DAO concept. The role of the state can be reduced to the level of an observer and the establishment of the Seconomics mechanism.

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