The Neural Networks and blockchain Technologies Implementation for the Regulation of Property Rights

Feng Wei
Department of Economics and Management
North-West Agriculture and Forestry University
Yangling, Shaanxi, China
weifeng@nwafu.edu.cn

Nadezhda N. Pokrovskaia[1], Marianna U. Ababkova[2]
Department of Advertising and PR
Peter the Great St. Petersburg Polytechnic University
St. Petersburg, Russia
[1]nnp@spbstu.ru, [1]nnp@ya.ru, [2]ababkova_myu@spbstu.ru

***Abstract*— Economy of knowledge is built on the ground of intellectual production. The efficiency of knowledge economy relies on the intellectual assets' market and regulation that requires smart solutions providing information security of the data processing. The blockchain' technology as a secure tool is already wide-spread within the individual contracting in the finance, management and governance. The Russian government discusses the possibilities to introduce this basic tool into public administration to assure the data safety, especially, to the creation and management of the State Registers, the Russian Association for Financial Technologies (FinTech Association) is established to help the digitalization process in the country. The FinTech Association produced the White Paper for Masterchain as a public resource for smart contracts can be used as an efficient tool not only for financial transactions or real estate register, but especially as a tool of the fast and secure processing of intellectual assets and exchange of ideas, providing high level of confidence for the knowledge' transfer. The paper includes the theoretical exploration of digital economy concept with the new tools of cloud and fog computing, Masterchain and crypto-currencies, the regulation of knowledge within the new context.**

Keywords*— *blockchain; Masterchain; cryptocurrencies; ICO; blockchain exchange; token; neural networks

I. INTRODUCTION

Property rights relate to the system of relationships between people built to restrict the access to certain resources, physical reality or intellectual assets. If State regulatory instruments for the governance in the field of property rights are subject to a number of negative effects (corruption, public-private conflicts, errors and distortions due to the inadvertency of the human factor involved, redundancy of regulation and contradictions between regulatory requirements, etc.), then intellectual tools, including neural networks and blockchain-technologies as a platform of regulative mechanisms, serve as an effective way of solving the problem of the property rights regulation.

In the framework of constructing a regulation network with neural and blockchain technologies, the integration of regulatory structures and regulated entities whose behavior is subject to technical or social regulation, can not only significantly reduce the costs of monitoring and control, but also increase the effectiveness of regulatíve mechanisms based on a higher level of trust of subjects as network elements to the functioning of the network.

II. NEURAL NETWORK TECHNOLOGIES AS REGULATIVE MECHANISMS

Neural network technologies are interpreted from the two essential standpoints: the hardware-software approach [1] and networks of communication as a means of interaction based on the direct transmission and exchange of concepts, images and unified integral symbols instead of words and signs [2].

A. Neural networks and neural communications

Neuronet as the next-generation Internet based on neural interfaces is based on the successes of neural informatics and cognitive psychology. The neuronet relies on the direct communication of unique nervous systems, without the obligatory use of natural languages, by connecting "cards" of nervous systems [3]. Such communication will exclude possible inaccuracies and omissions of verbal communication [4] and errors and distortions of the bureaucratic apparatus, therefore, neural communication between stakeholders will occur faster and more accurately.

Cognition, perception and processing of information, as well as interaction of subjects in carrying out regulative functions based through the neural communications and the neuronet will radically change the tools, methods and models [5] of the organization and functioning of the State apparatus in the next decades. The emergence of technologies for the direct transfer of concepts, images and sensations can also fundamentally change approaches to the State regulation of property rights, including the speed of documentary turnover, ways of transferring knowledge and skills, as well as new opportunities for stakeholder interaction.

To implement complex multidimensional communications in order to regulate property rights, it is necessary to use new protocols for the exchange and structuring of information to capture the values and meanings reated when two or more subjects interact with a property asset. Experts suggest that within the next 10-15 years, a mass technological solution based on the neural interface for the exchange of images and concepts between the participants of the process (HTTP-2 - Human Thought Transfer Protocol) [6] will be developed.

Neuronet as a new communicative environment also affects the creation of neuro-collectives, where all participants act as a

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single unit, unambiguously understanding the conditions and rules of activity, as well as the formation of management systems for complex processes, where stakeholders negotiate, coordinate and agree among themselves in the digital communications environment [7]. The neural communication protocol for these teams will speed up the coordination and decision-making, excluding errors and mismatches.

Thus, Neuronet can provide a technical solution to the main problem of modern public administration systems (preference for decisions that have quick returns and are of interest to small groups) and ensure the transition to the creation of effective governance structures [8] working in the interests of large communities (regions, nations, humanity) as one as a whole.

B. Socio-economic benefits of regulation based on neural networks and blockchain technologies

Neural network technologies and neuro-communication approaches have several advantages:

- they reduce the number of intermediaries, eliminating unnecessary costs and errors generated in the transfer of information [9], especially at the boundaries of industry languages (with inter-branch or inter-professions "translation"), for example, losses or misrepresentation of requests from users to technical groups, engineers or developers;
- they decrease the influence of emotional factors on the adoption of rational solutions, while intellectual systems, in particular, neural networks, are able to classify phenomena of reality to require rational solutions and / or to involve the ethical, affective perception and humans' evaluation;
- the use of the information technologies (IT) and, especially, of technical regulatory institutions and rules, forms the system of technical approaches to regulation. This shift is of importance in the conditions of widespread corruption, because the technical solutions enjoy a higher level of public confidence [10] than representatives of state authorities, officials, which is manifested, in particular, in the rapid development of e-democracy.

Thus, neural networks have both factual advantages over traditional social regulatory mechanisms, and subjective, from the point of view of human perception and judgements.

C. Ethical issues of neural networking regulative solutions

When the Microsoft' developers disabled two artificial intelligences due to the fact that they created their own language, which was incomprehensible to developers, to communicate with each other, this example demonstrates the problem of human control over the machine' reasoning and "intelligent" activity. Expansion of the sphere of machine, technical regulation of the choice of behavioral models made by humans raises several questions of ethics and control:

- to what extent a person prefers to transfer control over her/his own actions to the machine (intellectual system, smart environment, smart device, etc.);
- how the technical solutions allow the choice to be left to the discretion of the person. A number of cases of the reality go beyond strict classification (machine learning clustering, which requires the expert to intervene to clarify the object's entry into a particular cluster), due to the infinite variety of the real world' situations and circumstances. In particular, this involves constantly open expert participation in machine learning, but not on the initiative (request) from the intellectual system, but on the initiative of a person;
- how to take into account the changes in social and physical reality, including opportunism, in neural network regulative solutions. Therefore, the construction of a system of property rights regulation has to take into account possible workarounds or, on the contrary, potential use of technical regulation to achieve other goals, bypassing regulation. For example, voice agents, such as Siri, Alice, etc., can be used to perform operations (for example, to set an alarm clock) or to occupy the telephone lines of a company' competitor, thereby reducing the quality of its' customer service.

Ethical issues of regulative approaches, both in terms of their construction and correction, and in terms of their use, should be taken into account to improve efficiency of neural networks used for the regulation.

III. USE CASE OF BLOCKCHAIN SOLUTIONS FOR THE REGULATION OF PROPERTY RIGHTS IN THE MARKET OF FOREST AREAS AND CARBON QUOTES

The institutionalization of real estate transactions rests on State control and, accordingly, is a well-known example of both the institutional traps due to the long-functioning system of institutions and structures, and the slow regulation mechanism, which is not adapted to the up-to-date context with the high mobility of life today. The real-estate was perceived as the most sustainable assets' model, but in the actual conditions this sector can also be an example of increasing mobility.

The real estate sector represents now not only a number of physical tangible assets of the transaction (to build a house, to grow a forest, to create a farm), but also group of rights and flows, for investment purposes (including short-term investing, for example, to get profit from the difference between the foundation stage of a new building and the delivery of a finished object) or as a subject for derivative transactions, secured by the most reliable asset (land or a building).

A. Masterchain, a frozen Russian blockchain-product

An example of an attempt to build a blockchain-platform to optimize transactions with property rights is already created in 2016. Masterchain is a system with a distributed register based on blockchain-technologies, similar to the open source platform HyperLedger (Linux Foundation' product for finance, banking, IoT, supply chains, production and technology).

Masterchain is a combination of the State registering system and distributed data storage and processing, a

combination of centralization (Cadastre) and decentralization (network data storage system for transactions). The Masterchain platform is built in accordance with Russian cryptography standards and is a national system for implementing blockchain-technologies for the distributed recording of any data, for example, data on the transfer of ownership in cadastral register. The use of blockchain for cadastral purpose is already known in Great Britain since 2016, the Georgia as a country with a high level of IT-penetration in public administration has also introduced their Cadastral register on the basis of blockchain-technologies.

Despite the fact that Masterchain conducted test operations in October 2016, and then in November 2017, Megafon and Sberbank conducted transactions between themselves on the basis of Masterchain algorithms, until June 2018, this platform has not been accepted either by the banking sector for financial transactions, nor the State managerial apparatus as a model for recording the transfer of ownership or property rights' operations. In this connection, this article proposes to consider other possible ways of using blockchain-technologies for regulating the transfer of ownership of assets, especially, for the real estate sector and property rights on land.

B. The market of carbon credits

As part of the environmental orientation of global social development and, in particular, based on the Kyoto Protocol, the world carbon market has emerged. This market operates with pollution quotas, the amount of permitted emissions is determined on the basis of forest areas that are capable of absorbing the main negative effects of pollution. These quotas allow countries with significant unsettled forest-covered areas (for example, Russia) to consider payments of enterprises and other countries as a source of financing to cover the costs of infrastructure projects that do not damage the forest, as well as to the needs of agriculture for planting field and anti-erosion forest belts [11].

The prices for carbon credits increased by about 20% in North America over 2017 [12], that witnesses of actuality of the proposed options. Nevertheless this market today exists in its infancy and, in fact, is realized largely due to the efforts of governmental bodies and State acts (for example, Russia is selling quotas of its forest surface to other countries with significant volumes of industrial production and, accordingly, CO2 emissions). Private transactions and initiatives in this area are poorly developed and often represent a socio-cultural activity both from the seller of quotas (individuals who are personally interested in sustainable development and preservation of the natural environment for their children) and the buyer (in the case when enterprise has a responsible person making decisions, motivated not only economically, to avoid payment of fines, but also with cultural and social reasons to develop the environmental activities).

This dual situation is primarily due to the deficit of transparent operating mechanisms for quota transactions and habits, the lack of the routine of such operations: the search for information and the need for new knowledge can be too costly, so that responsible persons prefer to pay a fine for pollution and violation of environmental standards and not look for others ways.

The simplification of interactions and the standardization of quota sales for greenhouse gas emissions can reverse the negative externalities of emissions to the public goods of the purity of the natural environment through the market mechanism of transparent relations based on the technology of decentralized distribution of data storage as blockchain technologies. For this, 3 options are offered.

- creation of a blockchain-exchange with a transparent mechanism for transferring rights within the carbon market between entities;
- conducting an investment project based on the ICO (initial coin offering, the initial placement of crypto-tokens), the offering of a fixed number of emission quotas, carbon credits to the market for initiating trades;
- introducing a new crypto-currency, provided with quotas as emission rights.

C. Blockchain exchange

Online stock exchange trading tokens of various crypto-currencies are present today in the global space of the Internet, including Russian-language platforms. Among the most common services can be mentioned wex.nz, bestchange.ru, localbitcoins.net/ru and many others. The creation of such an exchange passes the stages of the life cycle from distrust, when a minimum number of tokens (currencies) are drawn from the first transaction, to the gradual development of the service and the connection of new participants.

Invitation to a new blockchain-exchange for the direct sale of carbon credits (both for national "fiat" currencies and for crypto-currencies) can be supported by the State, for example, by sending information to the entities together with the requirement to pay a penalty for exceeding emission standards. Like advertising published on receipts for payment of utilities, the requirement to pay a fine can serve as a means to promote information about such a blockchain-exchange. Participation of the State in the communication activities of the blockchain-exchange can play a key role and increase population confidence.

Communicative support can be provided by industry associations and unions of entrepreneurs, since it is not just a matter of solving a social problem, but also of the possibilities to reduce costs for exceeding emissions.

At the same time, from the socio-economic point of view, it is necessary to note the financial and economic logic of the enterprise evaluating the investment project for planning treatment facilities or equipment for technical reductions of emission: if the financial analysis of the project when compared with the cost of purchasing quotas shows its low profitability, the company, in any case, will refuse it, but in the case of carbon credits' market, it will administer these costs regularly as expenses accounted on schedule, reducing its tax risks and risks of verifications and fines. Such regular purchase of carbon credits and quotas can also be considered by the

enterprise as a component of social responsibility, to improve the company' reputation in the market and image of a bona fide taxpayer.

D. Primary Emission Emission Quotas for the ICO

Standard ICO procedures may be of interest for deciding whether to plant a new forest belt. E.g., an enterprise or an individual buying a "Far Eastern hectare" (privileged program to Russian citizens to buy land in Far East) or a different area of free surfaces, may decide to use this land to build an apartment building or to prefer its commercial use, or may choose to plant and cultivate a forest and sell it on the first placement of "carbon coins" (crypto-currency tokens) as the right to use the quotas from the planted forest. But the ICO tool is less suitable for existing forest belts.

In addition, the ICO for the carbon market has a number of effects that are defined subjectively: like any investment project, ICO needs a charismatic person who will represent the project individually as a personality, creating an impression for potential investors of the personal responsibility of the owner of the land. The subjectivity and personified nature of the ICO can both help or harm the project.

Finally, an essential feature of the ICO is the threat of the State attempts to regulate the crypto-currencies and investment projects expressed in. This remark applies to both ICO and the next option – the creation of a new crypto-currency, provided with forest areas and land with forest belts.

E. Creation of a new crypto-currency

Since the crypto-currency on the platform of block-technologies is created with minimal costs and can be immediately put on the exchange trading without any bureaucratic approvals, such a decision can be optimal for the sale of carbon credits on individual principle.

Crypto-currency is inherently a token (a record) that gives certain specific rights. In the case under consideration, the new crypto-currency will act as a direct recording of the emission quota (carbon credit), expressed in the corresponding forest area. "Carbon" currency as a new "altcoin" (alternative currency, crypto-coin), at first, will face the difficulty of entering existing stock exchanges trading crypto-currencies.

At the same time, thousands of already traded crypto-currencies have passed this way. Their historical path' analysis allows to draw a conclusion about the established model for the introduction of a new crypto-currency, especially in those cases when this new digital "coin" has the advantage of security. If most of the "alt-coins" are provided with intangible assets or intellectual property, for example, the right to access information (usually outside patent protection), then the proposed carbon crypto-currency will be provided by 1) international legal regulation based on the Kyoto Protocol, 2) national regulation of tax-penal relations in the sphere of environmental control, 3) tangible and measurable physical surfaces of actual forest plantations' areas, which are easy to see on maps and check with any geolocation tool.

This advantage of security and interest of large economic entities (industrial productions that carry out emissions) can make a carbon cryptonet a weighty financial instrument. If national currencies are provided with the GDP of countries, then bitcoin or ether is not provided with anything, while the carbon crypto-currency will act as a tool that combines both the advantages of simplicity and reliability of the blockchain tools and the tangibility of assets in the traditional sense.

CONCLUSION

Neural networks and blockchain technologies allow to significantly expand the opportunities for a transparent and efficient market of property rights. To select the use cases, the clear State regulation is necessary, which will take out the blockchain-platforms from the "gray zone" of regulative approaches and mechanisms.

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