

Master-chain as an Intellectual Governing System for Producing and Transfer of Knowledge

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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 cryptocurrencies, the regulation of knowledge within the new context.

Keywords— *digital environment; intellectual assets; transfer of knowledge; blockchain; masterchain*

I. INTRODUCTION

The digital economy of knowledge is a new environment for social and economic activity of all actors. The business players use the Industry 4.0 and connected factories' approach to optimise the internal processes and the supply chain. The individuals are able to conclude the smart contracts through the Ethereum contracting platform and to invest in ICO with crypto-currencies. The C2C credits represent an extending market that competes against the bureaucratic system of traditional banking institutions. Smart cities and fog computing are able to follow spontaneous movements of persons and physical objects.

The knowledge differs from other goods with two essential economic peculiar features: the knowledge increases when it is exchanged or consumed and the intellectual assets have high costs on the stage of production (fixed costs) and very low costs on the imitation or copying stage. These two core features explain the importance of the security in producing and transfer of knowledge that determines the interest towards the use of the block-chain and Master-chain in the knowledge turnover.

II. DIGITAL SPACE FOR KNOWLEDGE FLOWS

A. Digitising Industrial Policies

The national policies of connected factories (Japan) or Industry 4.0 (Germany), the supranational strategies of the Digitising European Industry (EU plan of creating Digital Single Market) and European Cloud Initiative (Building a competitive data and knowledge economy in Europe) are based on two assumptions: the total digitalisation of economic processes and the possibility to influence on the national and corporate business performance.

The connected world previously was built on the basis of the physical presence to monitor the reality with the physical instruments. The internet of things and the total digitalization permit to change the mechanisms of the regulation. The "digital twins" are created for the producing and consumption process, such as the transport units' monitoring for detection of the correct moments of the technical maintenance or power generation optimisation due to the up-to-date making decisions about the power use or necessary maintenance of turbines.

The digital twins of turbines, locomotives and jet engines (e.g., GE [1]) are the simulations with the machine learning. Sensors store and retrieve current state data, collect information from a connected device ("thing shadow"), the sensor data are used to update a "digital twin" copy of the device's state in real time [2] without involving engineers or technicians.

B. Transparency and decentralisation for meta-motivation

Technological solutions allow to transform the essence of socio-economic relations in regulation resources' flows.

The cloud and fog computing helps with observing and controlling not only for organisations or industrial chains, on the social level of the economic behaviour these technological approaches provide the registration of concrete acts and facts. The smart streets help with traffic or light regulation. The big data and sophisticated business intelligence tools are able to realise the task of assistance to understand the key transactions and to carry out the analysis of substance-over-form or doctrine of business purpose for tax regulation.

The resources flows' regulation, including investment and tax targets for national economies, could be better implemented

within the digital economy and to achieve a new level of transparency, e.g., to measure the real efficiency of incentives.

This ease of use and automated regulation tools raises the question of re-thinking the equity of tax system as a model of distribution of resources within a society or community, i.e., the regime of bitcoin is transparent for all participants, everyone of the network' members is able to check to origin of each coin (each token). This evolution raises the question of the core value assessment as a monetization of the meanings through the national or crypto- currencies within the connected world.

The creation of knowledge reflects the level of saturation of basic motives, the transcendent motives (meta-motivation) include the equity and search for truth, including the research and hunger for discoveries and inventions. From this point of view, the digital economy is built due to the creation of an open environment within socio-cultural evolution of human beliefs and interpretations of reality: mobility and regular systemic innovation as the context and core values.

C. Knowledge as meta-motivation

The humans produce knowledge during the whole life by learning and by attempts to understand the real world and to better co-exist with the reality. The learning process represents the assimilation of existing information and its' personalised enrichment with their own life' experience, the individuals contribute to the "given" knowledge and produce the new one.

The I. Nonaka and H. Takeuchi concept of the knowledge conversion spiral [3] represents the process of individualisation of knowledge with taking into account group and organisational cultures with sharing values and beliefs, common vision and goals. This transformation is based on the meta-motives of human as a personality within her/his social relations in the community and the national society.

The enriching personalisation of knowledge can produce the profit if it is built into corporate value creation chain or the national system of economy and innovative growth. In this case, knowledge and best practices require to be protected from unauthorised copying, that explain the reasons of the demand for security in a smart, connected world. Data privacy and the fair exchange of value for data are also increasingly important to customers [4] as well as for producers or sellers.

III. SECURE DECENTRALISED REGULATION. MASTERCHAIN

The blockchain is a reliable decentralized mechanism for fixing legally significant events in the digital world or digital identification systems. The monitoring and controlling that can be assured through cloud or fog computing are not sufficient, the weak point of the registering platform is the lack of a mechanism to assure the functioning of the parties concerned within a contract. The State historically plays the role of a mechanism to force market agents to respect their agreements and to prevent to opportunistic behaviour. Master-chain is targeted to cope with this deficiency.

A. Total digitalization for intellectual governance

The State interests towards block-chain technologies development and implementation are concentrated on the

support for customers and producers to secure their assets, to support the regulatory role of the authorities and to optimize the public economic policies on the basis of examination of the real choices made by economic agents.

Master-chain and HyperLedger are the examples of the block-chain platforms that are conceived for the different environments and for different purposes. HyperLedger is an open source that provides the collaborative space to advance global cross-industry block-chain systems, hosted by The Linux Foundation, including leaders in finance, banking, IoT, supply chain, manufacturing and technology. Master-chain is built according to domestic cryptography standards and represents a national system of block-chain technologies implementation for distributed registering of any kind of data.

The intergovernmental agreements are concluded for the mutual exchange of data for financial operations, that makes the economic activity more transparent for the national regulators. The new level of transparency needs the new understanding of the tools and goals of regulation in the field of any kind of rights, including the intellectual assets.

At the same time, the dilemma "efficiency – protection" in the case of knowledge policies demonstrates both positive and negative effects of regulation. The protection of the intellectual property is intended to create incentives for authors, because the regulation assures the rewarding for inventor' or author's efforts and costs used to the production of knowledge [5]. At the same time, the high level of regulation in the field of intellectual products decrease for new participants the access to the existing knowledge and previously created technologies or methods that reduces involvement of actors into knowledge transformation process and slow down the innovative growth.

The open sources prove the high level of the efficiency due to the access to multiple intellectual products for every customer or person able to contribute.

B. Intellectual production regulation

The regulation within cyber-economy is provided with powerful tools and methods, but the essential element is the cognitive mechanism [6] of goal-setting and understanding of the fundamental criteria and reasons for regulation.

The regulatory activities' analysis demonstrates the restricted set of tools and limited area of conceptual approaches toward the regulation of the economic reality and an inefficient impact on the investment activity.

The economy is affected with new context [7] of abundance of resources and the scarcity of needs (opposite to the traditional economy of scarce resources and infinite needs), the new business-models are oriented to the necessity of creating needs and motivations instead of satisfying them, to the search of integrators' functions instead of producing goods, the human resources' management is based on the search of talents who are able to "break the system" instead of competence to follow rules. In this context, the creativity of work and the open source represent an efficient environment to foster the knowledge.

The core factor of the efficiency for corporate performance is the possibility to create a new content and to use the diverse

communicative instruments, including the augmented and virtual realities, the smart spaces and smart equipment (smart houses, smart fridges, etc.). The connected world requires new competencies of creating meanings.

These new values and meanings should be measured and included into the management system that requires new understanding of the financial measuring system, where the monetary approach should translate the multi-criteria values into a common gauge. The specific mechanisms should be created for solving this task. The understanding of the new mechanisms of regulation in innovative connected environment raises the task to create the tools to assess the values and to embed regulation into the new transparent economic system.

C. Trustful environment as a culturally embedded phenomenon

The notion of trust is deeply enrooted in the socio-cultural regulation, in social norms and behavioural models, in the contextual countries with the centralised authority the population relies more on the official hierarchical structures and establishments, than on the open-sources platforms. E.g., for the post-factum payment [8], the author or inventor has to have a high level of trust for providing an initial free access.

The normative effectiveness depends on the credibility of the regulator and on the trustful relationship built between the regulator and the population. The trust is based on a clear and unambiguous regulatory mechanism [9]. The development of Blockchain as a system of computer algorithms and of Ethereum as a complex contracting system allows of creating non-personalized regulating algorithms [10] in any field of transactions.

D. Crypto-rouble

The analysis of the trends of the used regulation' tools demonstrated the differences of the approaches in Russia and in developed countries or other emerging markets. These differences are related to the choice of the tools and to the use of the multi-faceted regulatory capabilities of up-to-date digital economy, the level of centralization of regulative mechanisms.

Russian model of incentives for R&D is based on the State support and public budget for funding the scientific research. In Dutch model is embedded in the business need for applied research, in Russia the both fundamental and applied research. A number of crypto-currencies is already created in the world, and their advantage is their global meaning, but Russia declares the will to create a national "shadow" of crypto-currency – the crypto-rouble.

The Master-chain differs from HyperLedger with its State origin and administrative roots. The Master-chain is defined as a trusted information exchange environment and controlling impacts between those who do not trust each other parties. This system provides an availability of information to interested parties at the time of making changes and controlled transfer or exchange of ownership of financial instruments and assets with appropriate accounting.

E. Producing intellectual assets and protection issues

The data transfer is organized in efficient way by the technological means, but the content' creation and the new vision of the previous situation cannot be yet accomplished even by the smart things and even the Internet of things.

The collision between the very deep roots of the psychology of human behavioural models, constructed on the basis of a concrete representative system (cultural, religious, ideological, etc.), against the profit-oriented maximizing function led to the breaking out of the struggles, until the cyber-attacks and terrorism. The problematic field of the physical and psychological, emotional and intellectual security is enrooted in the communication failures on the macro- and micro- levels.

F. Regulation for neuro-communication

The communication is the core process in the economy of knowledge and experience. The communicative skills determine the adequate perception of the interlocutor.

Within the up-to-date development of the virtual space, the abilities of negotiating are transformed into a specific set of competencies of communicating with use of different technologies, gadgets and smart devices, especially, within the neuron-communications.

On the scale of corporate management, the key information security concerns are concentrated on the technologies of knowledge transfer, value creation' chains or networks, of communication inside the corporate unit and outside, the transfer of organizational culture towards the environment.

The Master-chain can be more confident and trustful environment for the neuro-communications, the direct transfer of knowledge, experience and feelings, including the perception of a reality (physical or virtual).

The security issues concern the substantial aspect of communication within the process of mutual understanding and ability to find a solution conforming to the interests of all partners, and the technological facet of the management of data flows and safety of intellectual property.

IV. CONCLUSION

The information and communication technologies (ICT) development proposed the new essential tools to monitor and control the reality. The fog computing and total digitalisation with the Internet of Everything reflect the processes of physical reality as "shadow". Intelligent, networked industrial machines autonomously coordinate and optimize work [4]. Neural communications transfer experience from one person to another, that change the marketing tools.

The regulatory bodies such as tax and customs services introduce the system of total transparency of all transactions inside a controlled economic space, the transfer pricing can be detected automatically with the analytical algorithms or economic intelligence [11]. The Multilateral Competent Authority Agreement assures the exchange of data between the national jurisdictions. The RFID-tags and other systems of

marking the goods help to control the products flows and movements.

The corporate governance and the national or supranational regulation are both influenced by the new context and need the business intelligence not only for fulfilling analysis and making decisions in the wide uncertainty, but especially to understand the dynamics and to rethink the design [12]. This conclusion has also an ethical aspect of the possibilities of capitalize the human meanings and of the monetary (or quasi-monetary) measuring.

The seeking goals, criteria and sets of values becomes the central concern for the regulation' evolution. The block-chain tools as a decentralised system of interactions raises the question of the efficiency of Mega-regulators such as Central banks. The findings of the statistics of financial flows demonstrated the new role of the mega-regulators as the regional integrators (similar to the services' integrators) to assure the regional infrastructure for development. The Master-chain is created for this purpose in the field of any contracts and transfer or rights. This ability to assure the security for assets and agreements makes the Master-chain a helpful tool for the securing the knowledge transfer.

REFERENCES

- [1] E. Biba, "The jet engines with "digital twins": How manufacturers act as on-ground mechanics for jet engines in the air", BBC, 14 Feb 2017. www.bbc.com/autos/story/20170214-how-jet-engines-are-made.
- [2] M.W. Grieves, *Virtually Perfect: Driving Innovative and Lean Products through Product Lifecycle Management*. Cocoa Beach, Florida: Space Coast Press, 2011, p. 133.
- [3] I. Nonaka and H. Takeuchi, *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. N.Y.: Oxford University press, 1995.
- [4] M.E. Porter and J.E. Heppelmann, "How Smart, Connected Products Are Transforming Companies". *Harvard Business Review*, 92, no. 11 (October 2015), pp. 64-88.
- [5] M.U. Ababkova and N.N. Pokrovskaja, "Communication policies and intellectual property transfer: efficiency and security in the post-modern information society", in *Conf. Security issues in the modern societies*. Yerevan: YSU publishing, 2016, pp. 93-99.
- [6] S.U. Glaziev, *On urgent measures to strengthen Russia's economic security and bring the Russian economy to the trajectory of advanced development*. Report, Moscow, Institute of Econ. Strategies, 2015.
- [7] J. Rifkin, *The Zero Marginal Cost Society: The Internet of Things, the Collaborative Commons, and the Eclipse of Capitalism*. Palgrave McMillan, 2014.
- [8] N.N. Pokrovskaja, "Tax, financial and **social** regulatory mechanisms within the knowledge-driven economy: Blockchain algorithms and Fog computing for the efficient regulation", in *Proceedings of 20th IEEE International Conference on Soft Computing and Measurements, SCM 2017, St-Petersburg*, 2017.
- [9] D.V. Golohvastov, N.N. Pokrovskaja and S.O. Snisarenko, "Institutional Confidence and Economic Intelligence for the Performance at Macro and Micro Networks", in *4th Conf. on Management, Leadership and Governance ICMLG 2016 Host. Reading, UK: Academic Conferences and Publishing*, 2016. – 528 p. – P. 255-263.
- [10] N.N. Pokrovskaja, "Neuro-communication and reverse rule of payment in the digital economy: the monetary evaluation of experience", in *2th Conf. Technological perspective within the Eurasian space, new markets and economic growth points*. St-Petersburg: Asterion, 2016, pp. 271-275.
- [11] A.M. Alexankov, d'Ascenzo F., Pokrovskaja N.N. "The management for Cyber-physical systems in the context of Industry 4.0 and regulatory mechanisms" in *XXI Int. conf. "Systems analysis in engineering and control" (SAEC-2017)*. St.-Petersburg Polytechnic University, 2017.
- [12] M.E. Porter and J.E. Heppelmann, "How Smart, Connected Products Are Transforming Competition". *Harvard Business Review*, 92, no. 11 (November 2014), pp. 64-88.