

Market Integration Assessment a Block Chain of Technologies in Regional Economic Systems in Comparison to the Global Supply Chain Management (On the Example of Regions of the Volga Federal District)

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Abstract- The article discloses methodological approaches to quantifying the level of penetration of block chain technologies into the regional socio-economic environment in comparison to the supply chain strategies. Based on the methods of mathematical and statistical analysis, it allows you to formalize and convert a large array of data of a qualitative order into a single scale for measuring the process under study - the level of demand in the regional socio-economic environment for block chain technology. The developed methodology is based on the theory of reputational economics, which allows, based on a system analysis of the global information space, to identify the level of demand for the research object in regional markets. Based on the collected and processed array of information and statistical data, the work carried out estimates of the index of reputation capital in the field of block chain technologies in the regions of the Volga Federal District for the period from 2010 to 2018. Based on the presented calculation data, a scientifically-based conclusion was obtained, according to which the regional "block chain" processes are beginning to take over the regional space of Russia more and more every year. Moreover, undoubtedly, as well as for any other phenomenon, this process is very differentiated in terms of penetration into the regional environment. In accordance with the estimates obtained, the regions with the highest level of demand for block chain technology and the outsider regions were identified. The implemented algorithm for the formalized assessment of the penetration of distributed data storage technologies into the regional

environment creates the basis for a comparative analysis of the development efficiency of regions, determining their current and future competitiveness in the context of globalization and digitalization of reproduction processes.

Keywords- *block chain technology, supply chain strategy, reputation economy, region, competitiveness, digital transformation, globalization.*

1. Introduction

Within the supply chain industry, the technology has now moved beyond the early proof of concept provided by bitcoin.¹ At the same time, the technical complexity of blockchain can be a barrier to entry for newcomers. The digital transformation of the economy forms a high dynamics of the ongoing changes in the system of relations of economic agents, in connection with which the study of its parameters and development trends is currently one of the most urgent tasks in economic theory and practice. One of the key components today, which occupies a special place in the process of digitalization of the economic system, is the block chain technology market, which generates a system of payments based on electronic cryptographic transactions and distributed data storage. Russian financial institutions, as well as enterprises in the real economy, are already testing this technology to offer their customers more convenient services (Figure 1).

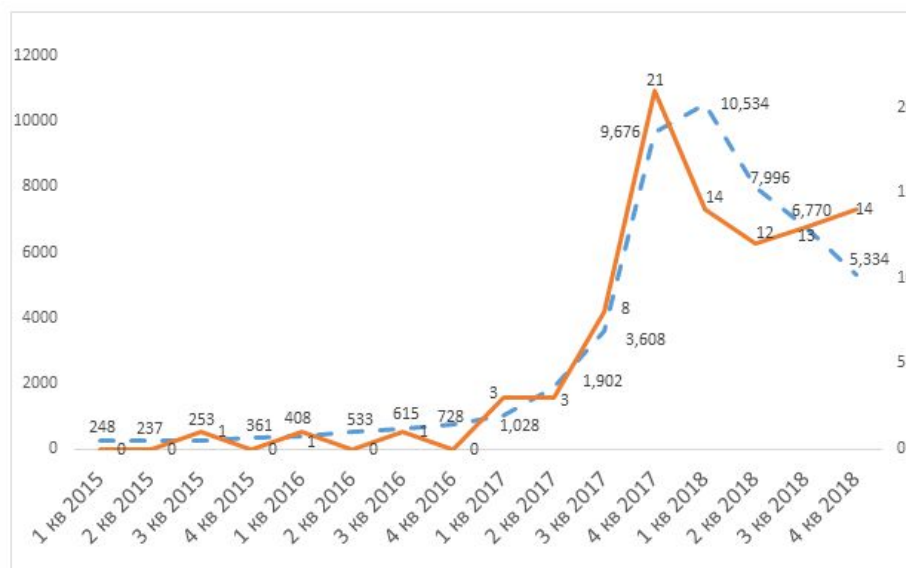


Figure 1. Dynamics of the number of recorded facts about the use of block chain technologies by the largest Russian companies (based on information from 500 major Russian companies by revenue)

As the implemented estimates show, the main consumers of block chain technologies at the current time in Russia are business entities of the financial sector of the economy, and the trend for their demand has, on the whole, a steady upward trend. Given the diffusion effect of block chain technologies, the latter will gradually penetrate the meso- and macro-level social and economic relations sector. Based on the identified trends in the effect of diffusion of block chain technologies in the national economic system, it is logical to assume that these processes will more and more cover the socio-economic space of Russia, following in the wake of the key trends of digitalization of the world economy. This conclusion is confirmed by published analytical data [1], according to which over the next five years, block chain technology will occupy a dominant position in the business operations management system. In this regard, an extremely important and urgent task is to conduct research aimed at searching for, determining the level of inclusiveness of regional economic systems in the processes of “blockchainization” of economic processes under consideration. The degree of penetration of the block chain technology market in their financial, economic, social and other systems will form, in the conditions of dynamically forming digitalization trends of the national economy, the level of their competitiveness and adaptability to the changes that are taking place. Meanwhile, it should be noted that a quantitative assessment of the degree of penetration of distributed storage technologies in the regions of the Russian Federation is a very non-trivial task. At the current time in the scientific and expert community there are no universally recognized approaches to its definition and analysis. Moreover,

in view of the relative novelty of the subject of research, there are practically no scientific publications devoted to this subject. This report attempts to break one of those barriers as it pertains to global supply chains. Specifically, the report addresses important criteria to make sense of public versus private blockchains and looks at how each affects the eventual supply chain solution. In this regard, it seems extremely urgent and timely task to search and justify methodological approaches that would allow to approach its solution. In our opinion, one of the options here may be an assessment of the demand for block chain technologies in the regions through the prism of the theory of reputation economics. It allows, in a concentrated form, to determine the demand for the studied object or subject of study by assessing the factors of institutional and market order, determining the tonality and meaningful characteristics of the parameters of the studied phenomena based on dynamically correcting signals in the global information space, which form representations / expectations of economic agents regarding development prospects and relevance of the studied processes.

2. Methods

The work of both Russian and foreign scientists is devoted to the solution of such questions in the context of using the principles of a reputational economy. However, it should be noted that either individual business entities (firms) [2, 3, 4] or regional economic systems as a whole [5] act as an object of study. In a concentrated form, Table 1 shows the main approaches and methods for measuring reputation capital.

Table 1. The main approaches and methods for measuring reputation capital

No	Name of method / author	The basis of methodological tools
1	Ex index	Determines the level of reputational activity of an economic entity, based on measuring the tonality of information materials on the subject of research in the Internet space [6]
2	M. Arslan and S. Seker	The reputation of the business entity (the study was conducted on the example of Turkish universities) is assessed on the basis of a normalized assessment of a number of factors (16 network parameters) characterizing their popularity and effectiveness in the WEB space [7]
3	Hossein Shad Manaman, Shahram Jamali, Abolfazl AleAhmad	The authors propose a system for measuring the reputation of a company using data on social networks (Twitter, Facebook, etc.). The algorithm is based on the principle of evaluating feedback profiles, which, according to the scientists, are divided into positive, negative, neutral, and inappropriate profiles for the company. In addition, the algorithm involves the use of the frequency of the analyzed profiles. As a result of using the method, integral indices are evaluated that evaluate the positive or negative image of the companies under study [8]
4	Yi Grace Ji, Cong Li, Michael Northc, Jiangmeng Liu	Similar methods of measuring reputation are used as in the previous method (No. 3) [9]
5	Peter Dorčák, Peter Markovič, František Pollákb	It uses algorithms for determining the tonality of search queries on the Internet, reflecting the level of positive or negative reviews about the analyzed object [10]

There are other works [11], however, all of them concentrate their attention exclusively on the micro level - the objects of their research are separately functioning enterprises and organizations. The use of the above algorithms and methods based on the theory of reputational economy, in our opinion, is possible in the context of this study, where the key task is the search and scientific justification of the solution that allows to form the basis for assessing the inclusion of regional economic systems in the processes of "block chain" economic processes. Relying on the methodological approaches of the above studies, the following is an algorithm for constructing integral indexes of the penetration of block chain technologies into regional economic systems (the Reputation Capital Index of the region in the field of block chain technologies I_{bchr}), and also presents the results of testing the proposed methodology on the example of the regions of the Volga Federal District. The developed author's calculation algorithm, in concentrated form, is presented below, it includes five main steps.

Step 1. Grouping the global information space by the level of reflection of the region's reputation background in the field of application or planning for the use of block chain technologies (information characterizing the development parameters of the digital economy and related elements).

Step 2. Grouping the global information space by the level of information impact (federal / regional level).

Step 3. Definition of the list of search queries $x_1, x_2, x_3, \dots, x_i, \dots, x_m$, related in meaning to the analyzed group of information space (information characterizing the

level of penetration of the digital economy, block chain technology into the system of economic processes in the region) and an assessment of their request ability for the analyzed time period p (x_i) - the number of requests (per month or year).

The following structure of directions is proposed for the functional analysis of the information web space in the field of assessing the reputation of block chain technologies in the region, based on four main sub-indices:

1. A sub index reflecting information regarding the popularity and applicability of block chain technologies in the region in practice (I_{bch}).
2. A sub index reflecting information on the information background of the region in the field of development of the instruments of the digital economy of the region (I_{ce}).
3. Sub index characterizing the information background regarding changes in the field of informatization processes (I_i)
4. A sub index reflecting information on the speed and quality of digitalization processes of the region's economic processes (I_e).

Each of the presented blocks is constructed based on the use of thematic search queries (Digital Economy, Block chain, Informatization, Digitalization).

It should be noted that the search query system used in this study, which forms the idea of the region's reputation capital in the sphere of its "blockchainization", is not "tough" due to the presence of a morphological analysis factor [12, 13].

Step 4. Definition of search engines in the web space by which the blockchain technology reputation index in the region I_{bchr} will be measured. This research phase is based on a mechanism that allows one to assess the popularity of a particular search engine, which determines and substantiates their choice for research in the field of identifying news background in web space.

Step 5. Calculation and quantitative assessment of the region's reputation capital index in the field of blockchain technologies I_{bchr} .

Stage I Assessment of the popularity of the request in the external environment (for each request)

$$I_i = P_j \times k; \quad (1) \text{ where}$$

i - request number;

P_j – probability of a click on the j th row of the query result;

k - information source level (federal / regional)

Stage II Determining the reputation of a request on the Runet (within the following search engines: Google, Yandex, Mail.ru - Search engines were selected based on rating data (<http://gs.seo-auditor.com.ru/sep/2018/01/>).

$$e_i = \sum d \times I_i; \quad (2) \text{ where}$$

d - share of the search engine in RuNet;

I_i - request popularity.

Stage III. Calculation and quantitative assessment of the region's reputation capital index in the field of block chain technologies I_{bchr} .

$$E_r = \sum e_i \times w_i; \quad (3) \text{ where}$$

e_i - reputation of the request;

w_i - The frequency of the search query. It is

determined based on statistics of requests (<https://wordstat.yandex.ru/>)

The limit values of the region's reputation capital index in the field of blockchain technologies I_{bchr} are in the range from 0 to +1.994 (according to the formed features of the methodology).

3. Results and discussion

In accordance with the methodological approach presented above, integral estimates of the reputation capital of the regions of the Volga Federal District in the field of blockchain technologies were obtained (table 2, figure 2 - diagram with areas and accumulation). The calculations were carried out for the period from 2010 to 2018.

Table 2. Integrated values of the reputation capital index of the regions of the Volga Federal District in the field of block chain technologies I_{bchr} for the period from 2010 to 2018 (regions are arranged in descending order of the index according to the results of 2018)

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Perm Krai	0.011	0.053	0.003	0.073	0.022	0.019	0.001	0.487	0.773
Republic of Tatarstan	0.369	0.282	0.038	0.455	0.595	0.291	0.434	0.563	0.659
Kirov Region	0.000	0.000	0.065	0.006	0.065	0.065	0.110	0.251	0.589
Ulyanovsk Region	0.012	0.020	0.025	0.010	0.012	0.020	0.137	0.861	0.572
Samara Region	0.026	0.081	0.043	0.081	0.066	0.026	0.042	0.269	0.435
Republic of Bashkortostan	0.118	0.000	0.072	0.163	0.083	0.212	0.235	0.285	0.430
Republic of Mordovia	0.098	0.000	0.000	0.234	0.152	0.234	0.326	0.215	0.389
Orenburg Region	0.000	0.000	0.000	0.028	0.028	0.002	0.030	0.086	0.328
Chuvash Republic	0.080	0.000	0.066	0.000	0.097	0.037	0.000	0.170	0.296
Nizhny Novgorod Region	0.000	0.150	0.063	0.093	0.141	0.000	0.082	0.203	0.293
Republic of Udmurtia	0.309	0.226	0.143	0.432	0.235	0.103	0.146	0.302	0.279
Penza Region	0.293	0.001	0.001	0.459	0.183	0.012	0.141	0.091	0.233
Saratov Region	0.056	0.000	0.119	0.156	0.123	0.065	0.123	0.275	0.206
Mari El Republic	0.129	0.129	0.079	0.410	0.126	0.150	0.079	0.221	0.204

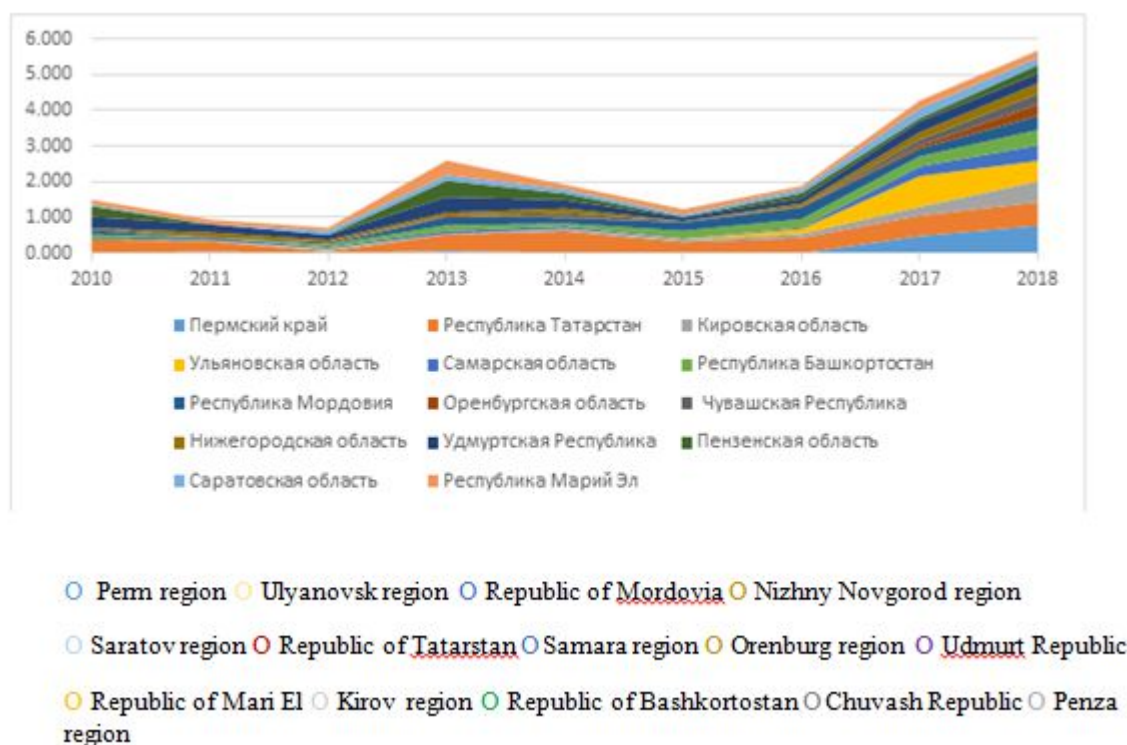


Figure 2. A diagram with areas and accumulation characterizing the cumulative level of development and popularization of block chain technologies in the Volga Federal District

4. Summary

Based on the presented calculation data, a scientifically-based conclusion was obtained, according to which the regional “block chain” processes are beginning to take over the regional space of Russia more and more every year. Moreover, undoubtedly, as well as for any other phenomenon, this process is very differentiated in terms of penetration into the regional environment. In accordance with the estimates obtained, it is necessary to state that the highest level of demand for block chain technology (according to the results of 2018) is noted in such regions as the Perm Territory, the Republic of Tatarstan and the Kirov Region. The smallest - in the Republic of Mari El, Saratov and Penza regions. It should also be noted that the achieved level of “block chain” of the regions is still far from its limit level, corresponding, according to the developed methodological tools, to a value of 1.994. This means the high potential growth potential of the block chain technology market. Given the significant growth trend for distributed storage technology in the regions, the latest statement seems to be very relevant.

5. Conclusions

It should be noted that the developed tools and their testing allow solving the most important scientific and practical problem in global supply chain strategies - conducting a formalized assessment of the territorial demand for block chain technology. Taking into account the effects formed as a result of their

application, and also, not losing sight of the fact that accelerated digitalization processes are observed in the national and global economic systems, understanding of the level of inclusiveness of regional economic systems in them forms the basic basis for conducting formal assessments of their competitiveness in the context of and processes under consideration. In accordance with the results obtained, it is advisable to assume that the next step in the study of the problem should be an analysis of the influence of the region’s reputation rating in the field of “blocking” on the parameters of its socio-economic development, as well as the development of a “road map” aimed at increasing the region’s competitiveness and strengthening its socio-economic potential based on the intensification of processes of penetration into regional economic processes of the key components of the digital economy, to which, by enno, you must include block chain technology.

Acknowledgments

The study was carried out with a grant from the Russian Science Foundation (project No. 19-18-00202)

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