

The study of software market in Russia

Kislitsyn E.V.

Ural State University of Economics
Ekaterinburg, Russia
kev@usue.ru

Panova M.V.

Ural State University of Economics
Ekaterinburg, Russia
kev@usue.ru

Sazanova L.A.

Ural State University of Economics
Ekaterinburg, Russia
kev@usue.ru

Abstract — One of the priority directions of development of the national economic system is the formation of Russian digital platforms and import substitution in the field of software. However, the current growth rate of the Russian software market is not enough to fully provide domestic products to all commercial and non-profit organizations and other structures. Therefore, ensuring the development of the Russian software market is an actual and urgent problem. The purpose of the research is a comprehensive study of the Russian software market and the identification of new points of its development. The significance of the work lies in a comprehensive analysis of the state and prospects of the Russian software market. The paper uses the methods of institutional, statistical, system analysis, classification and econometric modeling. As the results of the work we can highlight the empirical analysis of the dynamics of the Russian software market, including the level of competition on it. Also, the main directions of development of firms-software developers, based on the use of the potential matrix. The value of the study lies in the processing of a large array of data and its practice-oriented interpretation. The work can be useful both for specialists in the field of analysis of industrial markets, in particular the software market, and government agencies in order to regulate the market.

Keywords — *industry market, software market, regression analysis, potential matrix, software, digital economy.*

I. INTRODUCTION

The development of information technology is a key factor in the development of the digital economy and Industry 4.0. The structure of information technologies includes technologies for creating software products, artificial intelligence and control systems, communication technologies, service lines, database management, information security, computers, etc. (Popov and Suharev, 2018).

Thus, one of the priorities of the digital economy is the formation of Russian digital platforms for business management systems (Silin and Animica, 2018). The Russian software market received a new impetus with the introduction of import substitution policy in the country. Over the past decade, a fairly large number of new IT companies have

appeared on the territory of the Russian Federation, whose final product is not inferior to imported analogues (Borshch, 2018). However, the existing growth rates are not enough to fully replace all commercial and non-profit organizations and other structures with domestic products. Ensuring the development of the Russian software market is an actual and urgent problem in the current economic conditions in which the Russian Federation is located.

The aim of the article is a integrated study of the Russian software market and the identification of new points of its development. Achieving this goal is possible by solving the following tasks:

- 1) definition of the structure and current state of the Russian software market;
- 2) analysis of the level of competition in the Russian software market;
- 3) empirical study of the potential of firms in the Russian software market.

II. MODERN STRUCTURE OF THE RUSSIAN SOFTWARE MARKET

Based in this article on the basic postulates of the theory of industrial markets, organizational fields and neo-institutional theory, the market is understood as a set of institutional agreements in which there is an organized exchange of goods and resources between the participants, and their actions are regulated not only by prices, but also by structural relations, institutional forms and power hierarchies (Kislitsyn, 2017). The product of the market under study is software, namely the provision of non-exclusive rights to use this software. This product is a durable goods, which is subject only to moral wear and tear, but not physical. The mechanism of the software market functioning is shown in Figure 1. First, confirm that you have the correct template for your paper size. This template has been tailored for output on the A4 paper size.

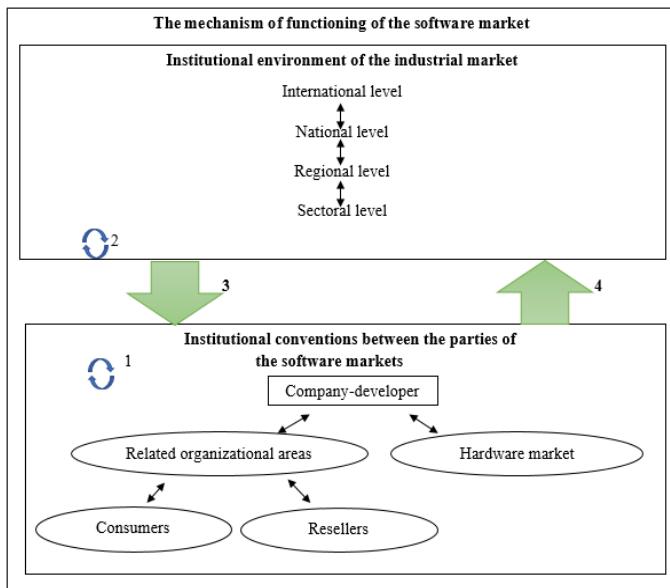


Fig. 1. The mechanism of functioning of the software market (compiled by the author)

The main market participants are the development companies, the main activity of which is the development of computer software (62.01 OKVED). Consumers of software market products can be divided into two sectors: consumptive and corporate (Perepechko et. all, 2017). Resellers are intermediaries that distribute software to both sectors of the consumer market. One of the important organizational fields is the hardware market, since software users are also consumers of the hardware market in any case. At the same time, part of the software can be sold pre-installed on the computer.

In addition to the main participants, the software market is significantly affected by the institutional environment. In particular, legal acts regulating copyright, licensing activities, as well as national and regional laws.

Nevertheless, being integral, the market of software manufacturers consists of several separate and often disjoint segments (Vinogradova, 2018). According to the classification of the degree of interaction with the hardware of the computer software is divided into three main categories: system, instrumental and applicative. Based on this, the software market can be divided into five segments:

1) System software segment – the market for operating systems, database management systems, drivers and utilities. The main feature of this segment is a high degree of monopolization and a high degree of competition from imported manufacturers. The drivers for the devices, as a rule, produce company, produce appropriate computer and peripherals, making them monopolies for each specific kind of software;

2) The information security market segment is the market for the production of anti-virus and other security software. This segment is characterized by the presence of several major players;

3) Internet and network software market segment – includes the production of browsers, HTML editors, machine translators and web graphics tools;

4) Business-oriented software segment – has the widest range of products and services, includes production of office software, text recognition and machine translation systems, instrumental software. Participants in this market segment have different sizes and market shares, including cloud computing market (Bataev, 2018);

5) The segment of communication and multimedia software also has a fairly wide range of products (Nikolaou and Lean, 2017).

In this paper we consider the Russian software market as a whole, without division into segments. This approach, on the one hand, allows for a comprehensive assessment of the development of the market under study, and, on the other hand, leaves the groundwork for further research of its individual segments.

The software market is one of the most dynamically developing in the Russian Federation (figure 2). Over the past 19 years, gross profit has increased 55.8 times (taking into account the reduction of prices to the level of 1999).

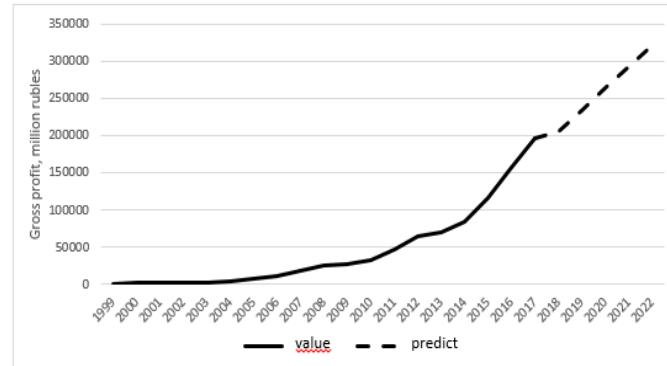


Fig. 2. Dynamics of gross profit on the Russian software market, 1999-2017 (compiled by the author on the basis of SPARK-Interfax data»)

In the period from 1999 to 2008, the growth rate of the market was from 22 to 50%, except for 2001, in which there is a negative trend. The crisis of 2008 also affected the market under study, so in 2009 the growth rate was negative and amounted to -7%. But then the market stabilized and to 2014 had the growth rate in the range of 3-20%. The events of 2014 gave a new impetus to the development and in 2015 the growth rate in the Russian software market was 19.6%, in 2016 – 27.8%, in 2017 – 22%.

Over the past 5 years, the market has changed key players, there are new fast-growing IT companies that have won a significant market share. The leading position in terms of gross profit is taken by Yandex LLC, the volume of which has increased by 1.6 times in 5 years. In general, all major IT companies in Russia have a positive trend in gross profit (table 1).

TABLE I. GROSS PROFIT OF THE LARGEST COMPANIES IN THE RUSSIAN SOFTWARE MARKET, BILLION RUBLES

Nº	Name	2013	2014	2015	2016	2017
1	YANDEX, LLC	18,6	20,7	21,1	24,9	30,7
2	KASPERSKY LAB, JSC	-	-	7,4	10,1	10,2
3	IRTIS, LTD	-	-	0,4	6,9	6,0
4	MICROSOFT RUS, LLC	4,3	3,2	3,1	3,1	3,2
5	NEFTEAVTOMATIKA JSC	0,6	0,7	1,3	1,9	2,8
6	YANDEX.MARKET, LLC	-	-	-	2,0	2,8
7	SBERTECH, JSC	1,0	1,2	2,0	2,5	2,6
8	PF SKB KONTUR, JSC	0,9	1,2	2,1	2,5	2,5
9	TAXCOM, LLC	1,0	1,2	1,3	1,5	2,2
10	LUXOFT PROFESHNL, LLC	0,8	1,3	1,6	1,9	2,0
11	CFT CJSC	1,6	0,8	1,2	1,6	1,7
12	1S-SOFT, LTD	0,1	0,1	1,1	1,4	1,6
13	MFI SOFT, LTD	0,3	0,2	0,9	0,8	1,6
14	INFOTEKS, JSC	-	0,6	1,2	1,1	1,5
15	OTR 2000, OOO	0,2	0,3	0,3	0,4	1,2
16	SPECIAL TECHNOLOGIES, LTD	-	-	0,1	1,9	1,2
17	CRYPTO-PRO, OOO	0,6	0,7	0,7	0,9	1,2
18	AZIMUT-ALLIANCE, CJSC	0,2	0,4	0,1	0,2	1,2
19	FORS- DEVELOPMENT CENTER, LLC	0,6	0,7	1,0	0,9	1,1
20	MARIEL, LTD	-	-	-	-	1,1

However, despite the accelerated development of this market, the available capacity is not enough to provide the necessary software to all enterprises and other structures, as evidenced by a significant share of imported software in Russia. To identify effective measures for the development of the market under study, it is necessary to determine the level of competition on it and determine the presence or absence of power asymmetry.

III. FEATURES OF COMPETITION IN THE RUSSIAN SOFTWARE MARKET

Some researchers have attempted to analyze the level of competition in the Russian software market. In the work of M. G. Klevtsova and A. A. Kononov the values of Herfindal-Hirschman, Gini and Lorentz coefficient indices for 2015 are

calculated, on the basis of which the conclusion is made about the low level of concentration, high competition and the predominance of a large number of small and medium-sized businesses (Klevcova and Kononov, 2017). In the work of A. E. Shastitko and A. A. Kurdin the question of the effect of the market power of the owners of key capacities is considered. In particular, the hypothesis of Microsoft's monopoly on several software market segments is put forward (Shastitko and Kurdin). However, such works are aimed at studying individual issues and do not consider the software market as a whole.

According to the SPARK-Interfax database at the end of 2017, 28363 enterprises and 39555 individual entrepreneurs operate in the computer software development industry in the Russian Federation. Analysis of the current state and trends of the Russian software market revealed the presence of several large market segments that operate with relative independence from each other.

In economic theory and practice, various statistical coefficients and indices are used to estimate the effects of competition (Orehkova, 2017; Bents and Silova, 2018). Due to the imperfection of statistical methods for assessing competition in some countries, surveys of business leaders are conducted (Kokovikhin et. all, 2018). Recent works in this field try to apply original, often mathematically more accurate methods (Kochkina and Radkovskaya, 2015).

This article uses a structural and functional approach to assessing the level of competition. The structural component allows to estimate the size of firms, market shares, the level of concentration (figure 3-4) and functional – the final performance of producers and consumers.

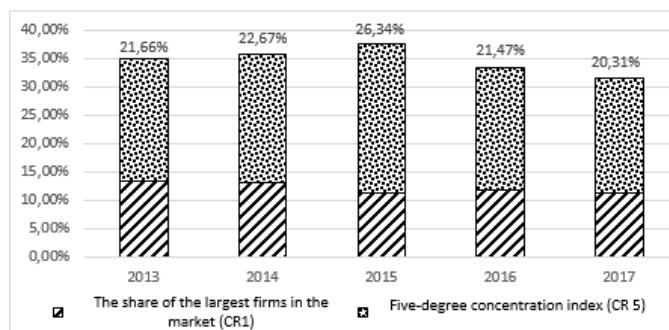


Fig. 3. Dynamics of software market concentration index (compiled by the author on the basis of SPARK-Interfax data»)

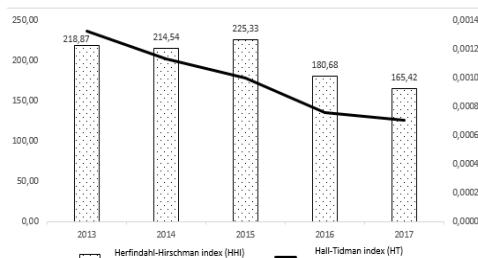


Fig. 4. Dynamics of indices of the Herfindahl-Hirschman index and the Hall-Tidman (compiled by the author based on the data "SPARK-Interfax»)

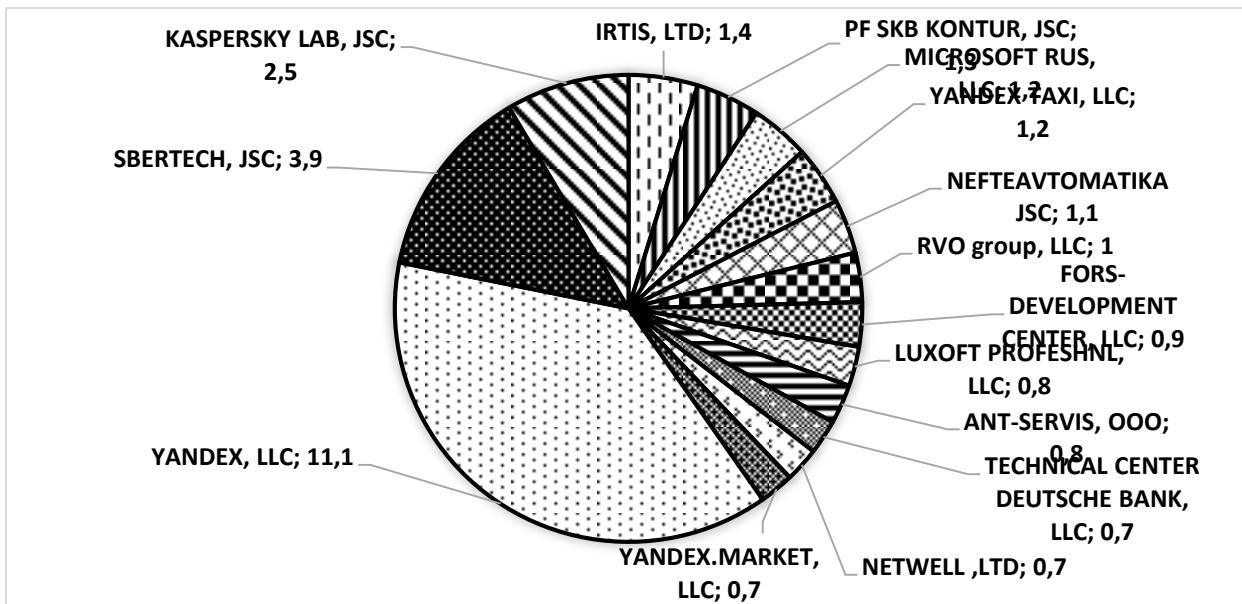


Fig. 5. Share of the largest software companies, 2017 (compiled by the author on the basis of SPARK-Interfax data»)

Yandex LLC is the largest developer company in Russia, being also the leader in the software markets in Turkey, Belarus and Kazakhstan. The main project of the company is a search engine with the same name, which occupies the 1st place in popularity in Russia and the 21st in the world. Also, the company's specialists develop various web services,

computer programs and mobile applications of various kinds. Despite its leading position, the share of Yandex LLC in the market fell by 2.23% in 5 years, while its gross profit increased from 18.6 billion rubles to 30.7 billion rubles. This discrepancy is justified by the accelerated growth rates of the Russian software market. In addition, the level of market power of the company for the study period is kept at the same level – the Bain index in 2017 is 0.279 (figure 6).

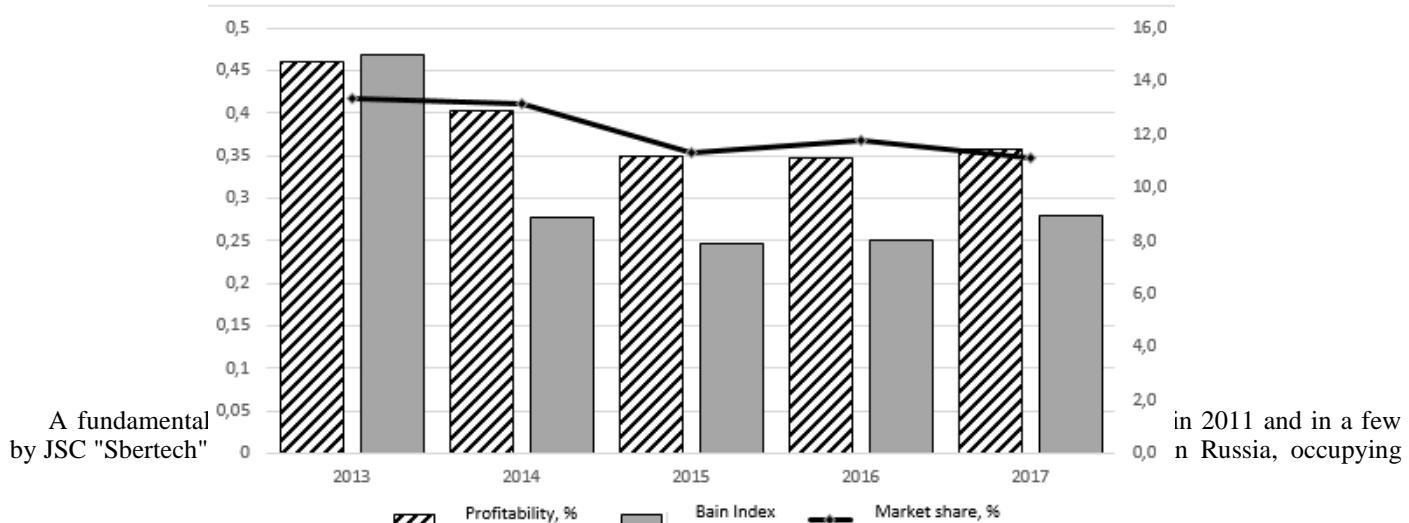


Fig. 6 Dynamics of market power and financial performance indicators of Yandex LLC (compiled by the author on the basis of SPARK-Interfax data»)

3.9% of the software market in 2017. Gross profit of the company for 5 years increased 2.7 times. At the moment, JSC "Sbertech" takes the 2nd place in Russia in terms of revenue in the software market. In addition, the Bane index, equal to 1,342, indicates the presence of this company's market power, greater than that of LLC "Yandex" (figure 7). This is due to the fact that the companies operate in different segments and the presence of JSC "Sbertech" main consumer – PJSC "Sberbank".

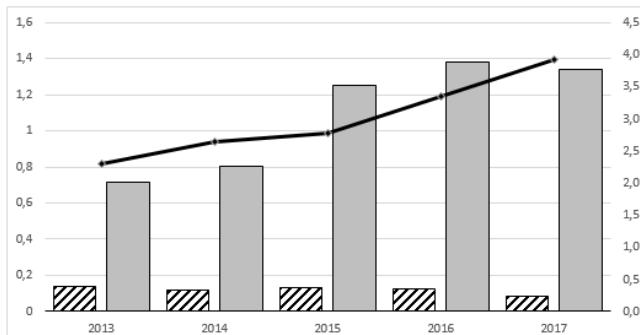


Fig. 7. Dynamics of indicators of market power and financial performance of JSC "Smartech" (compiled by the author based on the data "SPARK-Interfax")

Approximately the same position is occupied by JSC "Kaspersky Lab" and LLC "RT-invest transport systems". Data of companies are available only from 2015, and for three years they took 2.5 and 1.4% of the Russian software market, respectively. Both companies are highly specialized and are engaged in priority areas of development of the Russian economy. JSC "Kaspersky Lab" offers a wide range of software to ensure information security for both business and individuals. LLC "RTITS" is engaged in the development of the national system "Plato". Both firms have virtually no direct competitors, which gives them market power in their respective market segments. This is evidenced by the Bane indices, equal to 1.17 and 1.67 respectively.

The stable position in the market is taken by JSC PF SKB-Kontur which is the leading developer of the software in the Ural region. The company offers software solutions for small and medium-sized businesses, successfully competing with more powerful ERP-systems (in particular, with 1C products) and occupying 1.3% of the market for 5 consecutive years. Unlike previous facilities, the business software segment is characterized by low entry barriers and low market concentration (Babkin et. all, 2018). Nevertheless, the Bane index shows that JSC "PF SKB-Kontur" has a fairly high level of market power and sets the pace of development for other companies (figure 8).

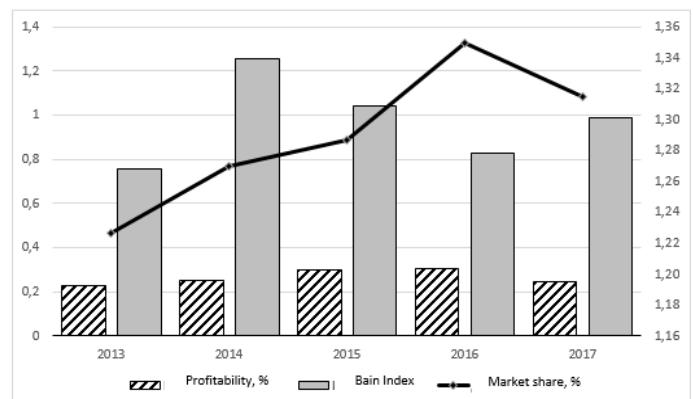


Fig. 8. Dynamics of indicators of market power and financial performance of JSC "PF SKB Kontur" (compiled by the author based on the data "SPARK-Interfax")

A similar position is taken by JSC "Nefteavtomatika", specializing in industrial automation. The main projects of the company are process control systems, local control systems of technological equipment, measurement and accounting systems, production and production safety. This company occupies 1% of the market, and gross profit for 5 years has increased almost 4.9 times. The Bane index also indicates that the firm has a high level of market power in its market segment (figure 9).

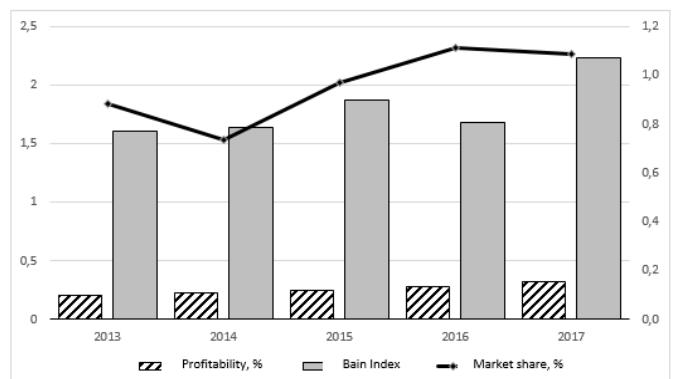


Fig. 9. Dynamics of indicators of market power and financial performance of JSC "Nefteavtomatika" (compiled by the author on the basis of "SPARK-Interfax")

Russia's policy in the field of import substitution had a negative impact on the development of Microsoft Rus, whose gross profit decreased over 5 years by 1.1 billion rubles, and the market share fell to 1.2%. At the same time, in 2013, this company took 2nd place in the market, second only to LLC "Yandex". The level of monopoly (market) power has also decreased due to the activation of Russian companies in the development of office software and operating systems (figure 10). It is in this segment that this organization operates.

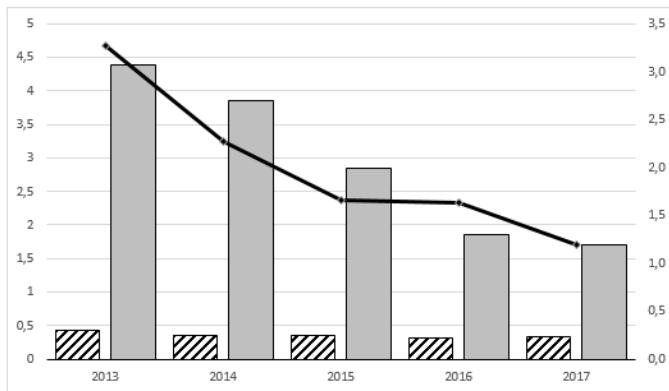


Fig. 10. Dynamics of indicators of market power and financial performance of Microsoft Rus LLC (compiled by the author on the basis of SPARK-Interfax data»)

On the one hand, measures of market concentration such as the Herfindahl-Hirschman index, Hall-of Tidman, concentration ratios, indicate the presence in the Russian market of software of monopolistic competition. However, this market consists of several large segments, each of which contains key players and large consumers. This is evidenced by the calculation of indicators of market power.

Thus, despite the relatively low concentration of the Russian software market as a whole, many firms have a fairly serious level of market power, which is primarily due to their presence in different market segments. Such firms have a strong enough influence over all stakeholders that they can directly or indirectly alter the terms of institutional arrangements. At the same time, it is important to determine the directions of their further development to ensure the growth of the Russian software market.

IV. WAYS OF DEVELOPMENT OF RUSSIAN SOFTWARE COMPANIES

Companies operating in the software market have several features that distinguish them from others. One of these features is the direct dependence of the company's revenue on the number of employees and the quality of their work (Gorlacheva and Erohin, 2016).

To analyze this dependence, we use Pearson's correlation coefficient for the parameter's "revenue" and "wages". In a sample study of 286 enterprises, the data were analyzed for the period 2013-2017. Pearson correlation Coefficient was calculated by the formula:

$$r_k = \frac{\sum_{i=1}^5 (Y_i - \bar{Y})(L_i - \bar{L})}{\sqrt{\sum_{i=1}^5 (Y_i - \bar{Y})^2 \sum_{i=1}^5 (L_i - \bar{L})^2}} \quad (1)$$

where «Yi» is the amount of revenue the i-year, to RUB; Li is the amount of wages in the i-year.

The results of the analysis are presented in table 2.

TABLE II. RESULTS OF CORRELATION ANALYSIS OF REVENUE AND WAGES

No	The value of Pearson correlation coefficient	Characteristic	Number of firms	Key representatives
1	$r \geq 0,7$	High direct dependence of the company's revenue on the number of employees. While extension staff with the same qualifications, the revenue of the firm will increase.	182	OOO "Yandex", JSC "Sbertech", JSC "PF SKB Kontur" JSC "Nefteavtomatika", LLC "Fors-development Center»
2	$r \leq -0,7$	High inverse relationship. The dismissal of employees with lower qualifications will lead to an increase in the company's revenue.	6	JSC "ICL-KPO AC", JSC "GIS ECOPROEKT»
3	$-0,7 < r < 0,7$	Low dependence. Changing the number of employees will not significantly change the company's revenue.	98	JSC "Kaspersky Lab", "ARTIS", OOO "Microsoft Rus", JSC "infotechs", LLC "Prime Group»

Thus, enterprises in the first group should increase the number of highly qualified employees to increase revenue.

Further, to analyze the development potential of development companies, we calculate the specific revenue for labor for 2017 by the formula:

$$N_k = \frac{Y_k}{L_k N_{\max}} \quad (2)$$

where Yk – the amount of revenue k-company; Lk – wages in the k-company; Nmax – the maximum value of revenue on the payroll of all firms.

The product of the specific revenue per Pearson correlation coefficient gives the degree of the firm's ability to increase market share through the use of human capital – the potential of the firm [Gorlacheva, P. 35]:

$$P_k = r_k \times N_k \quad (3)$$

The calculation results are presented in table 3.

TABLE III. CALCULATION OF FIRMS' POTENTIAL, 2017

Nº	Name	Revenue, mln RUB	Wages, mln RUB	r	N	P, %
1	YANDEX, LLC	86 060	12 473	0,9890	0,4068	40,2 3
2	SberTech JSC	30 320	26 239	0,9983	0,0681	6,8
3	KASPERS KY LAB, JSC	19 723	7 728	0,3329	0,1505	5,01
4	RTITS, LTD	10 993	1 829	0,5274	0,3543	18,6 8
5	PF SKB KONTUR, JSC	10 177	4 402	0,9886	0,1363	13,4 8
6	MICROSOFT RUS, LLC	9 246	3 808	0,0218	0,1431	0,31
7	YANDEX. TAXI, LTD	9 025	773	0,6810	0,6886	46,9
8	NEFTEAV TOMATIK A JSC	8 419	1 950	0,9950	0,2546	25,3 3
10	FORS-DEVELOPMENT CENTER, LLC	6 749	1 355	0,9534	0,2937	28

Note. Compiled by the author. The first 10 software manufacturers in terms of gross revenue in 2017 are presented.

The value of P indicates the extent to which market share can be increased. If P is high, it means that the firm has a high specific revenue on labor and the firm has a high level of dependence of revenue on the number of employees and, as a result, hiring highly qualified personnel, has the opportunity to increase market share. The potential matrix allows to classify market firms into five main groups (figure 11).

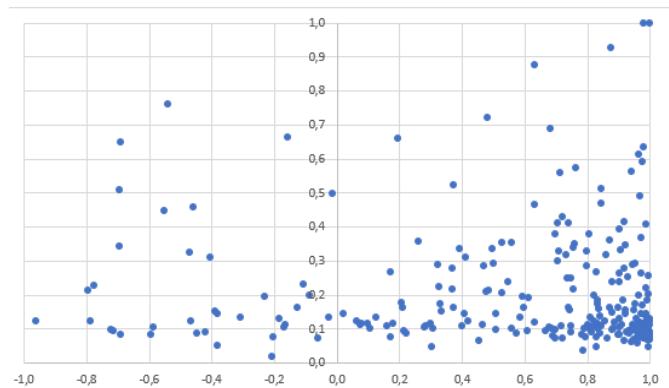


Fig. 11. The matrix of the firm's potential (compiled by the author)

The first group – companies with high potential to increase market share by attracting highly qualified personnel. Such firms have a high positive correlation between revenue and wages and a high specific revenue (upper right quadrant). Such companies include LLC "Yandex.Market", CJSC NIP "Informzaschita", LLC "Prime group".

The second group – firms with high potential to increase market share by reducing low-skilled personnel. Such firms are characterized by high negative correlation and high specific revenue (upper left quadrant). Such firms in the sample is extremely small – "Finvel Konsalting, LLC 1AB Centre Paveletskaya", Rtits, LLC etc.

The third group – companies with average potential to increase market share by attracting highly qualified personnel. Such firms have a high correlation and average specific revenue (lower right quadrant). Such firms in the sample turned out to be the vast majority, including LLC "Yandex", JSC "Sbertech", JSC "PF SKB Kontur" JSC "Nefteavtomatika", etc.

The fourth group – firms with an average potential to increase market share by reducing low-skilled personnel. Here the main characteristics are high negative correlation and average specific revenue (lower left quadrant). Such companies are JSC "ICL-KME" cs JSC, GIS ASPROJECT", CJSC "Digital Design".

The fifth group – firms with medium or low potential. This group includes firms with medium and low correlation and specific revenue (Central quadrant). Such companies include JSC "Kaspersky Lab", LLC "ARTIS", LLC "Microsoft Rus", CJSC "CFT".

V. CONCLUSION

The study produced a number of important results. First, the typical structure of the software market is defined. The main stakeholders are identified: software manufacturers, corporate and individual software consumers, Resellers and related markets. The main segments of the Russian software market are identified, their key characteristics are determined. Secondly, an empirical analysis of the dynamics of the Russian software market and the level of competition. On the basis of calculation of indicators of concentration and market power it is established that in different segments of the market there are firms possessing rather high monopoly power, contrary to the low level of concentration. And, thirdly, the main directions of development of the organizations working in the Russian software market are defined. On the basis of the matrix of potential, manufacturing firms are classified into five groups, for each of the identified areas of development in the field of personnel policy.

The value of the study, in our opinion, lies in the study of the entire array of enterprises operating in the Russian software market, processing of large statistical material and the availability of practical recommendations for enterprises.

References

- [1] Babkin A.V., Burkaltseva D.D., Betskov A.V., Tyulin A.S., Kurianova I.V. Automation digitalization blockchain: Trends and implementation problems. International Journal of Engineering and Technology (UAE), 7, 254-260.
- [2] Bataev A.V. (2018) Cloud Technology: Use Assessment in Russia in Crisis Conditions. IEEE Conference of Russian Young Researchers in Electrical and Electronic Engineering (ElConRus), Saint Petersburg Electrotechn Univ LETI, RUSSIA, 1244-1248.
- [3] Bents D.S., Silova E.S. (2018) Teoriya konkurencii: Pro et Contra [Competition theory: Pro et Contra]. Vestnik Chelyabinskogo gosudarstvennogo universiteta, 3 (413), 157-164.
- [4] Borshch L.M. (2018) Modernizaciya ekonomiki: tekhnologii Vs chelovek [Modernization of the economy: technology Vs people]. Izvestiya Ural'skogo gosudarstvennogo ekonomiceskogo universiteta, 3, 42-54.
- [5] Gorlacheva E.N., Erohin D.I. (2016) Raschyt potenciala rynka programmnoj obespecheniya [The calculation of the market potential of the software]. Vestnik Moskovskogo gosudarstvennogo oblastnogo universiteta. Seriya: Ekonomika, 3, 33-38.
- [6] Kislytsyn E.V. (2017) Mekhanizm vzaimodejstviya sub"ektor rynka s ogranichennoj konkurencij [The mechanism of interaction of subjects of the market with limited competition]. Izvestiya Ural'skogo gosudarstvennogo ekonomiceskogo universiteta, 4 (72), 98-115.
- [7] Klevcova M.G., Kononov A.A. (2017) Dinamika razvitiya malogo i srednego predprinimatel'stva v Rossii na osnove pokazatelej koncentracii rynkov [Dynamics of development of small and medium-sized enterprises in Russia on the basis of market concentration indicators]. Izvestiya Tul'skogo gosudarstvennogo universiteta. Ekonomicheskie i yuridicheskie nauki, 1-1, 242-250.
- [8] Kochkina E.M., Radkovskaya E.V. (2015) Matematicheskie metody prinyatiya reshenij na predpriyatiyah melkoserijnogo i individual'nogo proizvodstva [Mathematical methods of decision-making at the enterprises of small-scale and individual production]. Russian Journal of Management, 1, 69-78.
- [9] Kokovikhin A.Y., Ogorodnikova E.S., Williams D., Plakhin A.Y. (2018) Ocenna konkurentnoj sredy na regional'nyh rynkah [Evaluation of the competitive environment in regional markets]. Ekonomika regiona, 1, 79-94.
- [10] Nikolaou, C. K.; Lean, M. E. J. Mobile applications for obesity and weight management: current market characteristics. International Journal of Obesity, 1, 200-202.
- [11] Orekhova S.V. (2017) Resursy i ustojchivyyj rost promyshlennogo metallurgicheskogo predpriyatiya: empiricheskaya ocenka [Resources and sustainable growth of an industrial metallurgical enterprise: an empirical assessment]. Sovremennaya konkurenciya, no. 3 (63), 65-76.
- [12] Perepechko, L. N.; Sharina, I. A.; Rakhmanova, A. R. (2017) Intellectual Property Protection in Field of Information Technology. International Conference on Trends of Technologies and Innovations in Economic and Social Studies (TTIESS), Tomsk Polytechn Univ, Tomsk, Russia, 518-523.
- [13] Popov E.V., Suharev O.S. (2018) Dvizhenie k cifrovoy ekonomike: vliyanie tekhnologicheskikh faktorov [Moving towards a digital economy: the impact of technological factors]. Ekonomika. Nalogi. Pravo, 1, 26-35.
- [14] Silin Ya.P., Animica E.G. (2018) Kontury formirovaniya cifrovoj ekonomiki v Rossii [The contours of the digital economy in Russia]. Izvestiya Ural'skogo gosudarstvennogo ekonomiceskogo universiteta, 3, 18-25.
- [15] Shastitko A.E., Kurdin A.A. (2017) Effekty rasprostraneniya rynochnoj vlasti vladel'cev klyuchevyh moshchnostej na rynkah programmnogo obespecheniya [Effects of distribution of market power of owners of essential facilities in the markets software]. Upravlenets – The Manager, 4 (68), 43-52.
- [16] Vinogradova E.Yu. (2018) Aktual'nye voprosy proektirovaniya i realizacii korporativnyh sistem podderzhki prinyatiya upravlencheskikh reshenij na predpriyatiy [Topical issues of design and implementation of corporate decision support systems at the enterprise]. Izvestiya Dal'nevostochnogo federal'nogo universiteta. Ekonomika i upravlenie, 1 (85), 102-111.