Russian Local Trends in Software Development -Expectations and Reality. Resume of Studies in 2017-2019

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Abstract

Regulators of the Russian software market over the past 8 years have a significant impact on the market: from the serious requirements about the protection of personal data in information systems to the policy and state corporate?s programs of import substitution. This article contains a part of the results of two author?s researches (2017, 2019) that covered about 150 experienced engineers and managers in all federal districts of Russia. The expert?s panel reviewed the change in costs and efforts in software development projects connected with stricter requirements for collecting and storing personal data, preventing of data leaks, evaluated import substitution of system and application software and determined the possibilities of using technologies, based on open-source code. The results of the both studies are accompanied by analysis of dynamic of last few years and the brief recommendations of the author.

Index terms— software; development; regulation; Russia.

1 Introduction

? Competitive challenges of global environment;

? Rapid development of organizational approaches and production technologies; ? Significant rising of customer's expectations. ne of the key factors in profitable IT business is tracking and adapting successful trends, modern tools and technologies in optimizing software production. At this moment global software industry almost finished the agile transformation, when leading software development vendors switched their production process to "agile model", using scrum, extreme programming, lean practices and other methods.

Software industry despite of its globalization has significant local trends in every region and even country. Eurasian Economic Union and Russian software market in particular have some local trends that placed in focus of author´s studies in 2017 and 2019:

? Software import substitution; ? Management of personal data in information systems;

? Using of open-source technologies in software solutions.

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Those trends have their own story and specific aspects in comparing with European Union and USA software market trends that makes them interesting for analyzing.

From the one hand state regulators almost everywhere in the world came in high-tech domain. Operations of governmental regulators are focused on adherence to the rule of law, but it always connected with additional costs to market's players. Area of software development in Russia isn't so overregulated as other economical domains, but during last 8 years there is a set of local requirements, supported by governmental organizations. First of all it is a trend of import substitution in application and system software. Russia during last 25 year became one of the world leaders on software out-sourcing market (of course, with huge lagging from China, India and, perhaps, Israel) [1]. But we couldn't find even 10 word-wide known software products, developed in Russia at any application domain. Governmental course on import substitution started as a declaration and now became a real and very hard process. Now state organizations are have to looking for any software from special Russian list called "registry of Russian software". They should include anything from that list in their own competitions despite of quality or reputation of that software.

46 Another local Russian trend is raising efforts in information system development and design focused on
47 defending the personal data of customers. It has a long history from 2006 and in last 5 years received a
48 continuation, connected with political reasons. Every regulation in that area makes software companies again
49 and again rethink over this issue and (theoretically) spend more efforts.
50 Both of those trends are closely connected with using of open-source software solutions. Rising of its popularity
51 in Russia is not only economical issue, for local companies it's a part of competition on the state and the municipal
52 software markets.
53 This article presents some results of two author's research, conducted in all federal districts of Russia in March-
54 April of 2017 and November-December of 2019 and included the opinions of about 150 experienced engineers,
55 project managers, software architects. The main goal of those researches is to determine the demand for the
56 global trends in the O organization of software development. The researches were conducted via a questionnaire
57 with deferred feedback and with the opportunity for experts to comment on the summarized results. The studies
58 have the following tasks: 1. To determine the relevance in the Russian regions of current global world trends in
59 the development and design of information systems, approaches of the organization of software production; 2.
60 To get expert's opinions about local Russian trends related to the regulatory role of the Russian government and
61 the expectations of customers related with import substitution and open-source software, protecting of personal
62 and business data.
63 In this article there are the analyzed results of the second task of the research. The main goal of paper
64 is demonstrate the real reflection of different local trends in IT industry in practice of experts, who exactly
65 do software projects. Such kind of reflection demonstrates the differences between state's declarations and the
66 current overview in branch, based on geographically wide scientific research.

2   II.

3   Expectation of Russian State Regulators

69 Defending of personal data became a first notable demand to market from Russian state regulators. The
70 correspondent Federal Law No. 152-FZ "About Personal Data" was approved and entered in the force in 2006 [2].
71 In 2010 and 2017 the regulation has been strengthened and penalties were increased. For information systems
72 as well as for internet commercials it became a real issue and risk only somewhere in 2010-2011. Practically it
73 meant changing a lot of information systems in country -adding features to help adherence to the rule of law.
74 Second part of personal data regulation is connected with amendment of 2015 [3] and meant a strong demand of
75 storage personal data, collecting within Russia, on Russian territory. For example, LinkedIn has been blocked in
76 2015, Facebook and Twitter has been fined in 2020 for the second time, because of ignoring of that amendment.
77 Current Federal Law Act No. 152-FZ doesn't have any details and leave its defining to data operators. But
78 approximately from 2012 defending of personal data in Russia became one of the mandatory issues and risks in
79 information system design in state organizations. Current requirements of regulator shortly might be described
80 in following list:
81 ? All personal data, including name, address, date of ID documents should be stored within Russia; ? Personal
82 data storing has period and goal of its storing; ? Process of personal data collecting include mandatory agreement
83 of current person;
84 ? Person at any time might cancel its storing.
85 So, modern information systems on stages of design, construction and exploitation should consider this
86 regulation and contain relevant features for its users.
87 Another large area in regulation of software market is connected with Crimea's crisis and sanctions from side
88 of USA and EU in 2014. Counter sanctions and products embargo gave a trend of import substitution in grocery
89 area and one year later in hi-tech industries. Legally it based on Order of the Ministry of Communications about
90 approval of the plan for import substitution of software from 01.02.2015 no.96 [4]. Following the Order no. 96 it
91 went in three directions:
92 ? Corporate software with competitiveness of domestic software; ? Corporate software without competitiveness
93 of domestic software; ? Industry's specific software.
94 Segment of the market of corporate software, in which there is already a reserve of competitiveness of domestic
95 developments on local market, might be described by several examples: antivirus software (like Kaspersky),
96 browsers (like Yandex), business applications (like 1C.ERP or Terrasoft CRM). For sure, those examples might
97 be comparable with world class solutions in their domains and even without assistance from government: those
98 vendors have huge shares on CIS-market. The approach of the state in that direction is the granting of preferences
99 in the implementation of public procurement. In other domains sometimes it leads to unpleasant situations when
100 state organizations have to include in their competitions low-quality local software from "Registry of Russian
101 Software" according demands of regulator.
102 Next direction is the segment of the market of corporate software, there is no any reserve of domestic
103 competitive counterparts, but such kind of solutions are innovative and playing huge role in digital transformation
104 of business [5]. Examples: mobile operating systems, tools for managing the "cloud infrastructure", database
105 management systems (DBMS). The official state approach in that direction is assistance in the collective
106 development of this software. Author didn't find any real projects in that direction, except disjointed supporting

of Russian and "open-source based" different DBMS [6] in local projects of state organization in very little amount.

The third direction has a little share and huge potential: software related to industry specificity. Such systems are designed to ensure the development of health care, fuel and energy complex, financial sector, transport, etc. Approach of the state has a character of formal declaration -joint interaction with responsible ministries and departments.

Expectation of regulator in this area is focused on changing IT policy of all state organizations: slow replacing of USA and global corporate's application software to local products and slow replacing of system software to products, based on open-source technologies. According Russian former ministers the share of Russian software purchasing in state and municipal organizations has grown from 20% in 2015 to 65% in 2019. A lot of Russian state corporations from Russian Railways to huge banks (VTB, Sberbank, etc) already have been built and now implementing their own import substitution programs till 2023-2025 **??**6].

Also it should be noticed that sensitive data leaks became a real problem for huge corporations like banks, insurance companies or telecom operators. During last 3 years the number of cases of violation of data security is increasing [7]. Russian regulator RosComNadzor is involved in preventing the distribution and publishing of stolen data on regular base.

4 III. Local Russian Trends in Software Development Market

One of the goals of author's researches in 2017 and 2019 was the defining the reflection of IT domain professionals, who directly do software projects in Russia, of governmental regulation of last 7-8 years.

There were presented few main local trends in information system design, regulation of software business and the whole economy automation:

? The software import substitution in different aspects;

? The influence of increasing of the share of state and municipal competitions on local software market; ? The defending of personal data, restriction of it's an authorized using and protection from data leaks. Import substitution in system and application software is the main demand, forced by Russian government on municipal and federal levels by laws, projects and official polices. Participants of expert panel gave their opinion about the import substitution in the software industry in reflection of real projects and visible changes in Russian IT-industry. During last few years the system software import substitution became the visible trend, but it's influence has a very low importance (Table 1). Practically it means, that despite of Russian governmental declarations software managers and engineers don't see any market's changes according author's researches. For sure, lagging with developed markets like USA, Korea or Japan is very huge, but system software is a key for "information independency" although if in global transparent IT-world it's still possible. By opinion of author, Russia as well as other IT outsource exporters (India or Turkey) would never build any competitive system technologies for current existing devices like personal computers, smartphones or tablets. The economic reasoned recommendation here could be only investing in attempts on new devices markets (like drones, quantum computers, etc).

By the way the relevant example of China is remarkable -smartphone producing Chinese companies has started with cheap devices on Android, took a huge part of market and a bit later started to create their own system and tool software for smartphones. At the moment flagman smartphones of Chinese corporation could be counted as best in class in parameter "price\quality". But the current quality of system software produced by Chinese corporations couldn't be comparable with Google Android and it helps the consumers world-wide buy those cheap devices with updated versions of brilliant Android OS.

The import substitution of the application software as a trend in Russia is demonstrated in Table 2. Trend is not so obvious and experts said, that in last few years the import substitution of such kind slowed down. It could be explained by the common crisis in Russian economy and strong decreasing of investments in high-tech development in almost all Russian region state institutions -main objects for software import substitution. From the other hand overregulation in competitions for state organizations might have very controversial economical effect. Of course, it slows down digital transformation in governmental services, leads to a lot of problems: from risky data migration (from current systems to new ones) to hackneyed corruption in projects and competitions, where worldclass software should be on-demand replaced with local ones.

The trends of the import substitution and the growth of the state's share in the economy require development teams to comply with the requirements of official national standards (GOST) in software development. Despite of low actuality of those state standards for 2020 it could be assumed that GOST-34 and other relevant requirements of state customers might become the part of functional specifications and take a place in software project documentation. In next Table 3 there is the opinion of experts about the influence of GOST and other corresponding state standards on efforts of software development teams. Another long-lasting trend, regulated by state in IT-domain, is storing and operating with a personal data.

At first look it has similar roots with European or UK personal data regulation and legislation, but not for the last 5-6 years. Russian laws in data protection are focused on own state's rights firstly, and secondly refers to civil rights of corresponding persons. Official state demands should lead to additional efforts for software developments teams and in case of any abstract information systems it assumes the changing the whole cycle of data storage -from it receiving till utilization. The response from experts from author's research could be overviewed in next table **??**Table 5).

5   Table 5: Additional attention to the storage and operating with user's personal data

The tightening of Russian legislation in the field of collection and storage of personal data leads to additional requirements, which mean additional spend of resources and special attention to this issue. Do you mark extra attention, costs, complexity of the requirements for the collection and storage of personal data in information systems?

Answers: Study no. For last few years in software development world-wide there is a strong demand of data protection and additional efforts in information security. There are new policies, new hardware and software data protection systems, new approaches in complex data leaks preventing. Russian huge corporation like Sberbank or MTS accepted terrible faults in the protection of confident data and disappointed their consumers [7]. In next Table might be observed the integrated opinion of Russian software engineers and managers from author's study about the rising of complexity of customer's requirements and rising of corresponding efforts of software development teams in this area.

Table **??**: Attention to the security of information systems from leaks of business-relevant data Business data leaks have become commonplace in the world and in Russia. Do you note the complexity of customer requirements and additional efforts of the development teams to ensure the protection of information systems from data leaks in your region in the last 2-3 years?

Answers: Study no.2 from 12-2019 Yes, the requirements are increasing, teams spend more effort 39,7 %

No, everything stays the same low level 47,1 % Formally requirements (promises of software developers) increase, in practice -no 13,2 % Table **??** is demonstrating that this trend is valid for Russian market, but in this area there is a strong potential for Russian software solutions and development teams to increase their level of competition. For sure, software development teams should spend more efforts in preventing of the data leaks.

6   IV. Learn More About the Expert Panel

The studies were conducted in March-April 2017 and November-December 2019 using a similar methodology, including two rounds. The composition of both panels was selected through a network of professional contacts of the author in the industry or recommendations of qualified colleagues with the obligatory observance of the following conditions:

? The proven experience of each expert in software development in recent years; ? Age over 20 years; ? One IT-company might be presented two employees with different roles (engineer, developer, analyst, project manager) maximum, currently working in different projects; ? An expert's experience in software development is relevant to the one of the Federal Districts in Russian Federation.

In the first round, each expert answered a set of questions in a Google. Form questionnaire with predefined answer options. There are four sections of questionnaire:

1. The popularity of the tools, technologies, and patterns in software development; 2. The approaches of the organization of production processes; 3. The approaches to the design of information systems; 4. Local specific Russian trends (import substitution, data protection, etc.).

Further, the answers were generalized into a research results document by Google. Form tools in an automated mode. In Round 2 this document was sent to each expert. Some experts sent their comments, objections and comments, which were added to the final version of the research results. This article is dedicated to the results of last section.

In next tables there is the considering of the characteristics of experts participated in studies in 2017 and 2019 in terms of age, professional experience and regions of obtaining such experience in software development. In the study no.1 from 04-2017, 79 experts participated, and in the study no.2 from 12-2019, 68 experts participated. The personal composition of the participants in both panels coincided by approximately 40%. In both studies, a significant part of experts has been developing software for more than 10 years (Table 8), which means that during their careers the global relevant industry trends have been lasting for many years:

? Shift of development paradigms to "agile" methodologies; ? The rapid development of mobile software; ? Consolidation of the domination trend of web development, ? Active development of the concepts of three-tier, modular, micro service types of software architecture.

Also it should be noted that a significant percentage of experts in both studies are between the ages of 30 and 39. This age is the most fruitful in IT professions and is associated with maximum performance and professional success. The following table 9 shows the distribution of experts by experience profiles related to the direction of software development. Among the experience profiles are:

? Development for the company's own needs (inhouse development);

? Development as part of system integration projects;

? Development of software products for the market by the supplier (vendor -ISV); ? Custom software development according to unique customer requirements. The next table 10 there is the regional distribution of experts by capitals and federal districts. In both studies, more than a 30% of experts represented Moscow, which confirms the really high concentration of IT companies in the capital. Using open-source and replacement of proprietary software is a common trend for USA, EU and Russia. Russian system integrators are actively using open-source technologies for achieving competeness on local market. According author's researches for last few

years it became a part of import substitution trend, but mostly it has economic reasons -low costs of opensource software as a part of complex software solution. From the other hand the impact of state standards in software development still has a little level.

Regulation in area of personal data protection has an influence on software market: it took some attention of engineers and leaded to additional efforts in software development project. For last few years this trend became visible and experts in panel find the impact of regulator's demand and spent rising efforts to meet this requirement in their projects. Formal following to this demand in information systems in Russia might be done as "check mark" or other elements of graphical user's interfaces.

Data leaks still need more attention from engineer's team's side: despite of continues scandals with customers the real efforts of developers in this direction didn't rise a lot. Hopefully, protection of personal data and preventing of data leaks might be placed in focus of engineer's attention and customer's requirements.

In conclusion it should be added that strong and direct regulation in hi-tech domain is not working well, because the software market is global and transparent. Talented software teams are easily changing the country in case of overregulation, like it was with Pavel Durov Telegram Team in 2014. Or even big companies are changing their legislation and relocate the best teams in other offices, like it was with Luxoft in 2015. State policy in high-tech regulation should be soft and consider its leading role in the economy of new century. [1] [2]

1

Answers:	Study no. 1 from 04-2017	Study no. 2 from 12-2019
Software import substitution is going on actively	1,3 %	10,3 %
Software import substitution is going in very slow manner	82,3 %	79,4%
Difficult to answer	16,5 %	10,3 %

Figure 1: Table 1 :

2

Answers:	Study no. 1 from 04-2017	Study no. 2 from 12-2019
Software import substitution is going on actively	17,7 %	11,8 %
Software import substitution is going in very slow manner	60,8 %	70,6 %
Difficult to answer	21,5 %	17,6 %

Figure 2: Table 2 :

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3

Answers:	Study no. 2 from 12-2019
Yes, real compliance with GOST is needed more often	23,5 %
Yes, but for the most part it formality	4,4 %
No, I do not notice this trend	72,1 %

According Table 3 compliance with GOST standards still extends on a small amount of projects. But it can be forecasted that with growing of state share in economy this demand and corresponding efforts would increase.

Open source technologies and solutions have a significant influence in software industry world-wide. It's the usage in Russia is strongly connected with import substitution in official polices of state corporation and declarations of relevant state bodies. In Table 4 there is a consolidated opinion of industry's experts about popularity of open-source solutions and its role in import substitution in Russia. According the author's researches usage of open-source technology and it has an increasing impact on import In 2019 it became a visible trend, valuable economy.

Figure 3: Table 3 :

4

Answers:	Study no.1 from 04-2017	Study no. 2 from 12-2019
I see an increase in the usage of open source solutions related with software import substitution	13,9 %	29,4 %
I observe the growth of open source Technologies demand, but related with others reasons	49,3 %	45,6 %
No, I do not notice this trend in my region	24,1 %	10,3 %
Difficult to answer	12,7 %	14,7 %

According panel view it's a notable and
significant process, and Russian market in the same
trend as European. But around half of experts
connected rising of relevance of solutions, based on
open source technologies, not with import substitution,
but with natural economical and technical reasons. For
sure, implementation of "open source based" solutions
significant decreased project cost, because there is no
any need to pay license fees to any vendor.

Figure 4: Table 4 :

7

How many years have you been involved in professional software development, related projects and teams?

Answer:	Study no. 1 from 04-2017	Study no. 2 from 12-2019
1-3 years	2,5%	3,0%
3-6 years	32,9%	13,2%
6-10 years	20,3%	23,5%
10 + years	44,3%	60,3%

Figure 5: Table 7 :

8

Define your age group

Answer:	Study no. 1 from 04-2017	Study no. 2 from 12-2019
20-29 years old	41,8%	22%
30-39 years old	53,2%	61,8%
40-49 years old	5%	14,7%
50+ years old	0%	1,5%

Figure 6: Table 8 :

9

Answer:	Study no.1 from 04-2017	Study no.2 from 12-2019
In-house software development	15,2 %	19,1 %
Projects of system integration	11,4 %	10,3 %
Software (service, technology) development by independent vendor	36,7 %	27,9 %
Custom software development (including outsourcing)	36,7 %	42,7 %

Figure 7: Table 9 :

10

Answer:	Study no.1 from 04-2017	Study no.2 from 12-2019
Moscow	34,2 %	36,8 %
St. Petersburg and the Northwest Fed District	10,1 %	8,7 %
Central Fed District (without Moscow)	6,3 %	11,8 %
South and North Caucasus Fed District	7,6 %	7,4%
Volga Federal District	12,7 %	7,4 %
Ural Federal District	5,1 %	2,9 %
Siberia Federal District	21,5 %	11,8 %
Far Eastern Federal District	2,5 %	13,2 %
	V.	Conclusion

Mentioned in paper local trends in Russian IT industry has a strong impact on main branch parameters. Understanding of its current status and

Figure 8: Table 10 :

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