CLOUD SERVICE: STIMULUS FOR USERS TO ADAPT

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ANNOTATION

Information technologies are increasingly affecting the place and competitiveness of companies in the international field. All sectors of economy both state and private sectors, advanced information technologies are introducing, including cloud technologies .The main point of cloud technologies is to provide end customers with remote access to services, computing resources and applications (including operating systems and infrastructure) over the Internet. The aims of this research are: analysis of the propagation velocity of cloud technologies in Russia and world; definition of development drivers and barriers of distribution on the Russian market; identifying the prospects for the development of cloud technologies and proposing measures to stimulate the propagation velocity of cloud technologies. The survey of representatives of companies - participants in the cloud services market was conducted in order to analyze factors affecting the distribution of cloud services in Russia. With the help of factorial analysis of respondents' responses in the SPSS program factors identifying the direction of development of the market of cloud technologies are determined. According to the results of survey, the predictive values for the development of the cloud services market were made.

As a result of the study, infrastructure, economic, marketing factors, which promoting cloud services on the Russian market have been identified. There are legal, socio-economic, technological and marketing factors hindering performance of growth. Tools have been developed in order to stimulate propagation of cloud services.

On the basis of the obtained results it can be concluded that in order to preserve sustainable development, it is expedient to specialize companies in the production of one type or in a particular industry. It is also recommended to develop products for the public sector, this area of cloud service providers have only begun to master it. If other information technologies are usually offered to clients through IT directors, then cloud products should be promoted directly to directors of companies or other representatives who distribute the budget.

KEY WORDS

CLOUD TECHNOLOGIES, CLOUD SERVICE, FACTORIAL ANALYSIS, TECHNOLOGIES, PROPAGATION VELOCITY OF TECHNOLOGIES, DIFFUSION OF INNOVATIONS.

INTRODUCTION

Information technologies are increasingly affecting the place and competitiveness of companies in the international field [Trachuk A., Linder N., Antonov D., 2014]. All sectors of economy both state and private sectors, advanced information technologies are introducing, including cloud technologies. Their dissemination became possible thanks to the revolutionary development of its development – increasing the bandwidth of existing communication channels, inventing wireless data transmission technologies, increasing productivity, reducing the size and power consumption of computing equipment [Trachuk A., Linder N., 2017 г]. This allowed us to offer numerous computing services in the form of a network.

Cloud technologies provide remote dynamic access to computing resources and applications (including operating systems and infrastructure) over the Internet. There are many services based on cloud computing on different technologies, and there is no doubt that they will develop further, which is linked to the relevance of this topic of research.

The article deals with analysis of the factors influencing the distribution of cloud technologies, recommendations for encouraging the propagation of cloud services in the Russian market. The theoretical part deals with the concept and main types of cloud technologies, types of cloud services. The empirical part is devoted to the cloud technologies market peculiarities in Russia and analysis of the propagation speed. The variants of the practical use of the obtained research results are described.

DEVELOPMENT OF IT AND CLOUD TECHNOLOGIES

The metaphorical concept of "cloud" means a large range of resources, including computer hardware and software, to which easy access is provided via the Internet. The notion of "cloud services" appeared in 2006 [cloud computing, 2010] and has not yet received a generally accepted definition [Koniukhovsky P., Kuznetsova A., 2015; Trachuk A., Linder N., 2015a]. The US National Institute of Standards and Technology (NIST) definition of cloud computing is commonly used throughout the ICT industry: Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. [Badger L., Berstein D., BohnR. etal., 2011].

Other definitions have appeared due to expansion of the research range in the field of cloud services:

- *Private cloud* is the cloud infrastructure that one organization uses, where may be more than one user (business unit). The infrastructure can belong to a third party, be on the client's territory and beyond. The private cloud is presented as a new stage in the evolution of the data center. It provides all the advantages of virtual data centers, additionally provides highly integrated and automated management, scalable and flexible platforms, the ability to account consumption and self-service. The private cloud promotes the efficient use of resources within the organization, the dynamical redistribution of load between the physical systems of the data center [Yablonsky S., 2011].
- *A public cloud is* a cloud infrastructure prepared for open use by an unlimited number of users. The rights of ownership, management and maintenance belong to business, scientific and government organizations. The server is located on the territory of the cloud technologies provider. Public cloud is much larger than private clouds, as it serves the needs of a large number of organizations. Due to this, companies - providers of cloud services reduce the cost of computing resources. Acquisition of equipment and electricity, maintenance of infrastructure are cheaper due to the expense of discounts at wholesale purchase. The aggregate cost of a service received from a public cloud can be lower than that of a similar one from a private cloud for the end user. Customers do not need to administer themselves, modernize or repair IT resources while using public clouds, these services are performed by the public cloud service provider [Bogomolov I., Alexiants A., Borisenko O. and others, 2016].
- *Hybrid cloud* - the synthesis of private and public clouds. It is used very often in cases when company has a large amount of data and some has been stored on its own server, and some - in the "cloud".

Previously, companies had to purchase licensed software and infrastructure. The innovation of cloud technologies is provided by introduction of IT resources in the form of a service. Cloud technologies increase business agility by providing infrastructures, platforms and applications as services. The user is provided with the optimal configuration of services and the creation of an infrastructure that will help to solve effectively economic problems. The user pays only for the volume of the service that he used, which greatly increases the efficiency of using the software in terms of costs.

Cloud technologies have the following characteristics:

- *Self-service:* the user can independently configure the necessary set of cloud resources in automatic mode, without interacting with the provider's personnel;
- *Free network access:* with access to the Internet, access is available at any time from any platform (computers, laptops, tablets, smartphones, mobile phones, etc.);
- *Resource pool:* data centers, virtual machines, processing power, network capacity, etc., which are organized in a single pool to meet the needs of different clients;
- *Elasticity of choice:* the consumer can increase or decrease the amount of resources according to the needs at any time;
- *Measurable service:* the client can fully control the process of using the service, at any time request report, which is automatically generates and ensures the transparency of the service; monitoring allows you to monitor the storage capacity, bandwidth computational power, active user accounts [Trachuk A., Linder N., 2017a; Bolodurina I., Parfenov D., 2015].

Conditions for providing cloud services:

- suppliers conclude contracts with consumers for access to certain resources;
- consumers pay only for real consumption;;
- Cloud service providers provide access to them, leaving behind the issues of creating and maintaining the infrastructure [Krivoshapka I., 2016].

There are several models of its service depending on the needs of users:

- *Infrastructure-as-a-service, IaaS.* The consumer is provided with the computational power of the provider ("empty" virtual server with a unique IP address, network infrastructure, part of the data storage system). The user can control the operating systems, storage, and its applications but not the cloud infrastructure itself. The consumer uses cloud technology through a software interface;
- *Platform-as-a-service, PaaS.* The provider provides the user with access to the use of the software platform. The client purchases tools to open various business applications based on cloud technology, which are developed using the provider-supported tools and programming languages;
- *Software-as-a-service, SaaS.* The purchase-sale object is a ready-made provider application, available for use on various user devices There are "thin clients" (for example, a browser, e-mail with a web interface) and "thick clients",

(special platform-specific applications that are installed by consumers, for example, DropBox for different operating systems). The consumer temporarily uses the software to solve certain tasks, but does not acquire it [Onokoy l., 2016; Trachuk A., Linder N., Kuryatnikov A., 2015].

However, new models appeared on the market due to the development and popularization of cloud technologies:

- *Hardware as a Service, HaaS.* The customer is provided with equipment for use, on which he can create his own infrastructure;
- *Workplace as a Service, WaaS.* The organization can create workplaces of employees, having adjusted and having established for this purpose the necessary software;
- *Data as a Service, DaaS.* One of the most popular and common services, is a variation of SaaS The essence of the service is to provide the client with disk space for data storage;
- *Security a s a Service, SaaS.* A consumer can install systems that ensure the security of using web technologies and protecting the local network;
- *Everything as a Service, EaaS.* The totality of all the services listed above allows to solve practically. all IT-problems and tasks of the organization. The client is provided with equipment and software, and the ability to manage processes, and others [Polyakov S., Vyrodov A., Puzyrkov D. etc, 2015].

All cloud services according to the types of workload can be divided into several groups:

- analytics;
- database mining;
- business services;
- customer relationship management (cRM);
- e-mail;
- Enterprise Resource Production (ERP);
- team-work;
- audio-, video-, Web-conference;
- development and testing;
- development environment;
- test environment;
- infrastructure;
- servers;
- storage system;
- infrastructure for education;
- backup information.

In 2016, the total costs of consumers and companies on public clouds amounted to $ 209.2 billion in comparison with $ 175 billion in 2015 (an increase of 16.5%) [Gartner, 2016]. For comparison: in 2016, the world IT market as a whole increased only by 0.6%.

In the global market, IaaS solutions sales increased by 56%, to $ 25.3 billion, which contributes to growing demand for IT infrastructure services to the cloud and high-performance workloads like artificial intelligence, the Internet of things and analytics.

A good growth rate (23%) showed also the SaaS segment in 2016, which amounted to 38.6 billion dollars. It is expected that in the coming years this type of cloud services will account for more than two-thirds of the total market in monetary terms. The experts explain the dominance of the SaaS segment by the fact that the main demand in the public cloud market is concentrated around the applications. In the PaaS and cloud storage segments, the fastest growth is observed due to the increasing popularity of Big Data analytics and Internet services for developers. The implementation of decisions PaaS's decisions brought 7.2 billion dollars In 2016 against 3.8 billion dollars a year earlier.

According to various estimates, the Russian cloud services market is increasing by 20-35% per year in ruble terms. Forrester Russia's analysts concluded that the domestic cloud market, as well as the world market, will grow faster than the IT market as a whole, and by 2020 its volume will be 48 billion rubles. [Kolesov A., 2017].

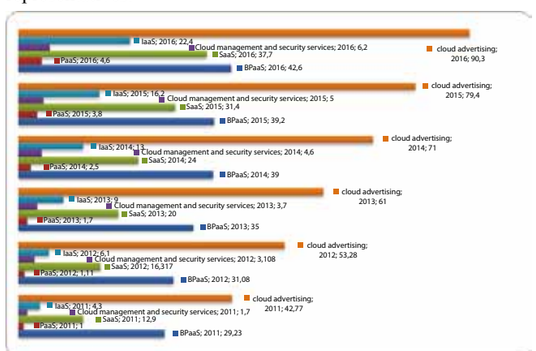
The structure of cloud sales in Russia differs from the global picture: the largest market share (58.9%) belongs to the SaaS model, IaaS and PaaS are 37.2% and 3.9%. The reason is the underdevelopment of small businesses, which is the main consumer of SaaS. According to statistical reports [Simmon E., 2018], the share of Russian companies with "cloud" technologies does not exceed 20%, which determines the relevance of this study.

FACTORS AFFECTING PROPAGATION SPEED OF CLOUD TECHNOLOGIES

There is only a limited number of studies on the factors affecting the speed of distribution and adoption of electronic technologies, especially cloud services, which are not yet sufficiently researched (Table 1). In our opinion, further empirical studies on factors influencing t introduction of electronic technologies in the context of cloud services are needed.

RESEARCH METHODOLOGY

In order to analyze the factors affecting the distribution of cloud services in Russia, 75 representatives of companies - participants of the cloud services market - were interviewed. There are system integrators (29%), developers of cloud services (48%), client companies (23%) (Table 2) among Companies' representatives.



The volume of the cloud services world market, billion dollars. [Gartner, 2016]

– «Cloud» advertising; – infrastructure as a service; – cloud management platforms; – security as a servic; – platform as a service; – «cloudy» application development platform

The interview touched on such issues:

- trends of the cloud technologies' market development in Russia;;
- preferences of Russian clients regarding the model of providing cloud services;
- prospects for the development of various types of cloud services;
- advantages of cloud technologies and development drivers of this market;
- disadvantages of cloud technologies and barriers to their propagation;
- peculiarities of Russian market of cloud services;
- special aspects of this market development in various areas;
- development prospects of the cloud services market and forecast for the next few years.

The mathematical forecast of market development is a very difficult task. The largest advisory agencies are building their forecasts on the premises.

There are serious differences in the methodologies, since the concept of "cloud technologies" has not been developed.

The main factors , which will contribute to the development of the cloud technologies market and barriers that could prevent further propagation in the next few years, have been identified. In order to conduct factor analysis all respondents were sent a questionnaire in which it was necessary to assess the importance of the factor from "0" = "does not affect" to "7" = "main driver / barrier". The respondents' answers were subjected to factor analysis in the SPSS program.

The factor analysis allows you to divide an array of variables into a small number of groups, which are called factors.

The data are grouped according to the following principle:

- variables between which there is a high degree of correlation (close relationship) are combined into one factor;
- variables with a low degree of correlation- (weak relationship) are attributed to various generalizing factors. [Oliveira T., Thomas M., Espadanal M., 2014].

The value of the correlation coefficient, close to zero, indicates a low degree of interrelation. A negative value indicates the existence of an inverse relationship. A value close to -1 indicates a strong inverse relationship.

RESEARCH RESULTS

The factor analysis allowed classifying the growth factors of cloud services market in the next 3 years, as well as barriers that will lead to zero growth rate in subsequent years.

Also, the estimation of model factors description completeness was carried out with the help of Kaiser—Meyer— Olkin valid when test value is more than 0.5. This requirement is met in our study and it shows acceptability of the constructed factor model (Table 3).

Table 1

Analysis of factors of adoption and dissemination of electronic technologies in the commercial sector

Contribution	Research method	Research issue	Research focus
Min H., Galle w. P, 2003	Questionnaire, Survey	Company size, industry and a limited set of advantages and disadvantages	Internet, exchange of electronic data
Davila, A., GuptaM., PalmerR., 2003	Survey	Barriers and benefits of introduction	Introduction of e-procurement by 168 American companies
Henriksen H. Z., Mahnke V., Hansen J. M., 2004	Questionnaire, Survey	Company size and a limited set of advantages	Electronic Auction
Muffato M., Payaro A., 2004	Case-study	Advantages of e-procurement	Electronic Business Models
Kothari T., Hu c., Roehl w. S., 2005	Survey	Applicability of e-procurement in the hotels' sphere	Introduction of e-procurement in the hotels' sphere
Eadie R., Perena S., Heaney G. et al., 2007	Questionnaire, Survey	Possible advantages and organizational characteristics	Electronic Markets
Teo H. H., wei K. K., Benbasat I., 2009	Questionnaire, Survey	A set of possible benefits and organizational characteristics	Electronic purchases via the Internet
Gunasekaran, A., McGaughey R. E., Ngai E. w. T. et al., 2009	Survey	Identified barriers, critical success factors and identified advantages of electronic procurement of Hong Kong companies	Implementation of e-procurement
Trachuk A., Linder N., 20176	Regression	Factors affecting the distribution of e-business tools, propagation speed	Distribution of e-business tools in the Russian industry
Pogosyan A., 2016	Simulation modeling	Factors affecting propagation of electronic payments	Distribution of electronic payment services
Trachuk A., Linder N., 2017	Literature review	Factors of new mobile services adoptions by companies in the network of propagation and consumers	Distribution of mobile services on the markets of consumers and companies in the propagation network
Trachuk A., Kornilov G., 2013	Survey	Factors of electronic payments propagation	Peculiarities of Russian propagation
Trachuk A Golembi-ovsky D., 2012	The Bass Model	Factors contributing to non-cash payments propagation	Peculiarities of the Russian market' non-cash payments
Alexa S., Volodin Yu,.2017	Literature review, Survey	Factors contributing to the promotion of mobile applications	Peculiarities of the withdrawal and evaluation of mobile applications promotion on the Russian market
Khasanov A. Trachuk A., 2016	Literature review, empirical study	Factors contributing to the promotion of mobile applications	Features of mobile applications propagation on the Russian market

Table 2
Distribution of respondents

Characteristic	Amount of respondents	Share in sample, %	Distribution according to work focus area of company		
			System integrator	Developer	Client
Gender					
Male	45	60	13	22	10
Female	30	40	9	14	7
Company seniority					
1–3years	19	25,33	6	8	5
4–7 years	33	44,00	10	18	5
7–10 years	13	17,33	4	6	3
More than 10 years	10	13,33	2	4	4
Level of hold position					
Specialist and senior specialist of unit	27	36	7	15	5
Manager of unit	15	20	6	7	2
Head of unit	22	29,33	4	8	10
Head of department	11	14,67	5	6	0

Table 3
KMO and Bartlett's test

Indicator	Analysis 1	Analysis 2
Kaiser—Meyer— Olkin's Test	0,614	0,647
Bartlett's test of sphericity: an approximate chi-square Bartlett's test	 527,154 0,000	 450,458 0,000

The Bartlett's test examines the hypothesis whereby there is no correlation dependence between variables involved in factor analysis. The significance of the Bartlett's test (0.000) indicates that the initial hypothesis can be rejected with an error probability of 0.000. It is incorrect. Correlations exist between variables of the original array and it is possible to group them in accordance with tightness of the correlation.

We can conclude that the initial data of our example is suitable for carrying out factor analysis due to the study results.

So next we should analyze the correlation matrices of the two models in order to trace the interrelations between the

Table 4
Initial eigenvalues of factors, contributing to the propagation of cloud services

component	Total	Dispersion %	Total percentage
1	4,724	42,948	42,948
2	1,709	15,539	58,487
3	1,324	12,033	70,520
4	0,861	7,831	78,350
5	0,756	6,872	85,222
6	0,569	5,174	90,396
7	0,380	3,454	93,850
8	0,342	3,113	96,963
9	0,156	1,415	98,377
10	0,130	1,178	99,556
11	0,049	0,444	100,000

coefficients. The number of components is determined by calculating the characteristic numbers. The values of the characteristic numbers are indicated in the second column of Table 4. In this case, the condition is set: the value of the characteristic numbers must be more than one. The maximum value of the factor model components is 3 for cases in which the given index exceeds unity. So the optimal number of groups (factors) is 3 in the factor model.

The fourth column of Table 4 shows the percentage of information stored in the process of grouping the original array of variables using the factor model. Approximately 70.5% is a good indicator.

Table. 5 shows the correlation coefficients that characterize relationships between variables of the original data array and e components of the constructed factor model (factors). According to the general rule of factor analysis, variables of the source array that have the closest relationship (the highest value of the correlation coefficient) to the given component of the factor model are assembled into one group (under one factor). On the basis of these data, the variables of the initial array are grouped and presented in Table 6. The factor analysis of barriers that lead to zero growth rate is carried out similarly.

It is necessary to determine the number of groups in which these factors can be divided as it was done in previous analysis.

Table 5
Rotated matrix of components – factors contributing to the propagation of cloud services

Indicator	Component		
	1	2	3
Awareness	0,255	– 0,040	0,886
Competition	– 0,192	0,862	– 0,174
Perfection	0,709	– 0,084	0,528
Budget cut	– 0,261	0,426	– 0,489
Act on Custody	0,723	– 0,046	0,327
Overcoming of trust problem	0,045	– 0,242	0,807
Complications	0,733	– 0,478	– 0,092
Development of new technologies	0,790	0,027	0,211
Currency exchange rate	– 0,031	0,900	– 0,030
Import substitution	0,674	– 0,338	0,002

Table 6
Grouping of source array variables according to the revealed correlation coefficients

Variables	Coefficients
Infrastructure components	
Improvement of Federal Law [Federal Law 2014] Complications Development of new technologies Import substitution	0,709 0,723 0,733 0,790
Economical components	
Competition Cuts in the IT- budget Currency rate increase	0,862 0,426 0,900
Marketing components	
Awareness Social Signal Overcoming of trustproblem	0,886 0,341 0,807

The optimal number of groups (factors) in the model describing the barriers to the spread of cloud services is also 3.

The initial array of variables using the factor mode l in the process of grouping and approximately 73.3% of information is stored, which is a good indicator (Tables 7, 8). The grouping of variables of original array is shown in Table 9.

CONCLUSIONS AND PRACTICAL APPLICATION OF THE RESULTS

Thus, it is possible to distinguish infrastructural, economic, marketing factors that help to promote cloud services in the Russian market (Table 10).

There are some difficulties for cloud services growth:

- Legal factors:
  - o legislation: some requirements of the law [Federal Law of 2006] complicate the development of cloud technologies in Russia and prevent penetration of European companies into our market in particular;
  - o the lack of up-to-date legal documents regulating dependent relations between provider and client;
  - o lack of law enforcement practice of the already existing regulatory framework;
- Social and economic factors:
  - o The reluctance of CIOs to lose control. Usually, CIOs give an impetus to the development of technology persuade CFOs to try something new from what is offered high-tech markets.in high-tech markets in high-tech markets. The situation is exactly the opposite in the cloud service market. The acquisition of cloud services allows the company to reduce staff and budget of the IT department and to reduce the company's dependence on the IT department. CIOs no longer dispose of new equipment purchase, which means they lose some of power and opportunity to get a "kickback" from suppliers for purchasing equipment. Thus, the use of cloud technologies also leads to financial losses of IT-departments directors;
  - o Slow adaptation of large software manufactures price policy to the cloud model, which in the future can make the purchase of cloud services inexpedient;
  - o Lack of qualified specialists.

Table 7
Analysis of barriers of cloud technologies propagation

Component	Total	Dispersion %	Total percentage
1	4,388	43,878	43,878
2	1,709	17,090	60,968
3	1,231	12,315	73,282
4	0,756	7,564	80,846
5	0,606	6,061	86,907
6	0,553	5,533	92,440
7	0,349	3,493	95,933
8	0,190	1,902	97,835
9	0,148	1,479	99,314
10	0,069	0,686	100,000

Table 8
Rotated Component Matrix

Indicator	Component		
	1	2	3
Current legislation	– 0,135	0,787	0,445
Lack of specialists	0,859	– 0,107	– 0,204
Insecurity of data	– 0,051	0,265	0,900
Own infrastructure	– 0,323	0,157	0,725
Lack of practice	– 0,067	0,662	0,357
Resistance of IT Directors	0,452	– 0,310	– 0,435
Adaptation of prices	0,911	– 0,034	0,013
Incompatibility	– 0,254	0,094	0,785
Lack of awareness	– 0,517	0,733	– 0,160
Lack of standards			
Service Level Agreement	– 0,024	0,863	0,111

- Technological factors:
  - o Own IT infrastructure. Acquisition of its own data center is expensive, companies have to wait until it pays off;
  - o Compatibility with the current IT infrastructure;
- Data security. Companies are wary of moving critical for business applications and personal clients' information to the clouds due to the hacker attacks;

The stimulation of cloud services propagation could be made with the help of:

- specialization in one kind of product or industry: it is easier for company to win trust in a particular niche, which is one of the main drivers of cloud services market development;
- development of products for the public sector: competition among providers of cloud services is still small;
- distribution of cloud products through company directors or other representatives, who distributing the budget,

Table 9
Grouping of source array variables in accordance with the revealed correlation coefficients

Variable	Correlation coefficient
Social and economical components	
Lack of specialists Resistance of IT-directors Adaptation of prices	0,859 0,452 0,911
Legal components	
Current legislation Lack of practice Lack of awareness Lack of Service Level Agreement	0,787 0,662 0,733 0,863
Technological components	
Insecurity of data Own infrastructure Incompatibility	0,900 0,725 0,785

Table 10

Factors contributing to the cloud services propagation

Infrastructure factors		Economic factors	Marketing factors
Technological	Legal		
• tendency of information volumes increase and complexity • development of intelligent solutions of a new generation: machine learning systems, predictive analytics, Big Data • improving cloud solutions for business	• Federal law July 21, 2014 № 242Ф3 • import substitution requirement for foreign products	• Growing competition of modern business • Cut of the IT-budget due to the crisis • Growth of dollar and euro, so company start to change hosting from foreign into Russian	• Company leaders knows better about the benefits of cloud services • implementation of cloud services as a sign of a modern mobile company with a flexible business structure

- by informing about savings and data security as the advantages of cloud technologies;
- development of SaaS applications: not all small and medium-sized businesses are benefiting from this technology yet.

These recommendations can be applied by companies operating in the Russian cloud technology market, to maintain sustainable development in the period of the forthcoming stagnation, obtaining stable competitive advantages and increasing its own market share.

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