Estimated aggregate cost of ownership of a data processing center

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Abstract

Under current conditions, we see growth in demand for IT outsourcing services. This implies the activation of design and construction processes for data processing centers (DPC). Since a DPC is a complicated and expensive system, there arises the issue of justifying selection of the future project based on the estimated costs of designing and operating data processing centers.

This paper analyzes one of the possible complexes of measures to estimate costs for development and operation of data processing centers. The analysis identified main groups of capital cost in development of data processing centers which were not fully taken into account in assessments of the total volume of capital investments in previously proposed methods. The article proposes regression models to evaluate processing center construction projects based on two measures. We propose to estimate the capital cost as a function of the projected floor space of service platforms and projected number of server racks. On the basis of the models developed, analysis of the construction sites of processing data centers was conducted. This showed the model's suitability to real data. The main groups of operating costs for DPC maintenance were established, and a regression model of their evaluation was proposed. Based on the regression equation, we propose to calculate the processing center's power consumption depending on the area of the service platform or the number of server racks. The operating cost of the data processing center is determined by the power value. Analysis of information on the operating cost of various data processing centers is in fairly good agreement with the calculations obtained on the basis of the model developed.

The proposed models make it possible to evaluate with reasonable accuracy the project characteristics of development and subsequent operation of a data processing center.

Key words: data processing center, regression model, construction, representativeness of the sample, cost structure, operating costs, capital costs.

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Introduction

Under current conditions of market relations, we see expansion of the tertiary industries sector along with an increase of the outsourcing share. Services like IT outsourcing are becoming very attractive. The main producers and suppliers of IT outsourcing services are modern data processing centers (DPC), which provide a sufficiently wide range of different IT services for consumers. By using a DPC, the customer can make effective administrative decisions under conditions of limited abilities to attract financial resources for development of the company's own IT infrastructure while finally ensuring a stable and break-even point in the company's business. Thus, it can be assumed that the demand for IT outsourcing services will be growing. Therefore, the task of developing tools for pre-estimated costs to implement such expensive and resource-intensive projects as development of data processing centers becomes a subject of great current interest.

The appearance and development of DPCs are directly linked to a multiple increase of processed and stored information volumes, the need to ensure high operational capability of mission-critical applications and business continuity processes.

Based on the implemented functions and core requirements for data processing objectives and processes, a DPC can be defined as a complex solution intended for high-performance and reliable data processing, storage and transmission having a high operational capability. The solution also includes an engineering infrastructure comprising a significant share of costs both in the course of the center's establishment and operation, i.e. in the aggregate cost of the system's ownership. On the other hand, the DPC is a combination of a large number of software and hardware platforms of various kinds – servers, data storage networks, operating systems, workload management systems and data backup built in according to specific business needs of its owner.

Based on the high level of complexity of the data processing system, it is necessary to select a set of measures for estimating costs on a reasonable basis which may occur in the processing center's development and operational phases.

Similar problems have already been solved. The solution results are presented in papers [1–3]. In the solution, the indicated problems of foreign experience were primarily considered. Let us consider the data relating to national DPC development projects.

1. Structure of cost for DPC development

Analysis of papers [4–6] enables us to identify the following four main groups of capital costs:

1. Building construction. A high-quality DPC (beginning with level Tier 3) should be located in a freestanding building with special characteristics. For this reason, the construction cost can differ from similar projects for building storage premises. However, the building can be taken on lease. In this case it should be brought into compliance with all technical requirements.

2. Grid connection. Data processing centers are distinguished by large amounts of power consumption. Therefore, they need a separate power input from the power plant. If for level Tier 1 and 2 DPC one power input line is sufficient, a Tier 3 DPC requires one active and one standby power input line, and a Tier 4 DPC needs two active lines.

3. Optical cable. It is important to note that every year the server throughput capacity is growing. In this regard, requirements for optical cables and their cost are increasing. It is assumed that there is increased demand for link capacity of communication lines (assuming an increase by a factor of about 4).

4. DPC engineering systems. The cost of backup power supply, procurement of uninterruptible power supplies, provision of the cooling system, raised floor, routing of electrical networks and purchase of equipment (racks, etc.) can be referred to this article.

Having summarized the investigation results on the cost structure [1, 7, 8], the following components of the data processing center construction costs can be identified:

1. Building construction (~ 10-15%);
2. Grid connection (~ 20-25%);
3. Optical cable (~ 0-5%);
4. DPC engineering systems (~ 60-70%).

Capital costs are generally determined by DPC surface area (associated with a number of racks) and Tier level reliability. The data provided in article [9] makes it possible to estimate the cost parameters for construction of the engineering infrastructure for a certain representative project of a data processing center (*Table 1*) and evaluate the dependence of these parameters on the DPC reliability level.

However, these costs do not fully reflect the total capital investment in building a DPC. If we take into account construction of additional premises required for secured assurance of center operation reliability, the cost

Table 1.

Cost of DPC

Cost of DPC construction		
Tier II level	Tier III level	Tier IV level
Cost of 1m² of DPC		
$10 579	$13 941	$25 767
Cost per rack		
$26 447	$34 852	$64 417

of construction of 1 m^2 (main area) increases by a factor of 2.2, and costs per rack increase by a factor of 2.4. The cost of 1 m^2 of one level Tier DPC construction can vary significantly depending on the total surface area of the center. In addition, the proposed evaluations do not make it possible to extend this data to the DPC project of another configuration and do not allow us to take the construction region into account, which also has a significant impact on the cost.

Therefore, estimation procedures based on the cost detalization are untenable for project evaluation in the initial phases.

2. Regression model of capital costs

All the cost components listed above are directly or indirectly related to such characteristics of the data processing center as the surface area or number of racks. In this connection, it is reasonable to develop a model which would enable us to conduct the project assessment via these two measures.

To meet the target, data on 70 processing center construction projects was collected in Russian for the period from 2008 to 2014 (*Table 2*).

Table 2.

Original data sample for DPC construction project

Name	Year	City	Project cost	Total area, m²	Area of service platform, m²	Number of racks, pcs.	Power, MW	Level, Tier
Irkutsk-Energosvyaz	2014	Irkutsk	2.5 bln. Rub	10000	3200	1300	NIA	3
Government of Chelyabinsk region	2014	Chelyabinsk	27 269 000 Rub	12000	NIA	1600	16	NIA
Ministry of Health of Tula region	2013	Tula	no information available (NIA)	NIA	NIA	NIA	0.8	NIA
Gazprom Neft	2013	St. Petersburg	NIA	NIA	NIA	NIA	NIA	3
Irkutsk region	2013	Irkutsk	30 bln. Rub	NIA	NIA	NIA	30	NIA
VimpelCom	2013	Yaroslavl	4 bln. Rub	15000	3000	1200	10	3
Rostelecom	2013	Moscow	30 mln. US$	11500	10000	NIA	40	3
Sibirtelecom	2012	Novosibirsk	70 mln. Rub	215	NIA	60	3	NIA
Inoventica	2012	Vladimir region	90 mln. Rub		300	60	0.45	3
Rostelecom	2012	Stavropol	NIA	280	250	20	NIA	NIA
Electronic Moscow	2012	Moscow	114.5 mln. Rub	530	250	93	1	NIA
Dataline	2012	Vladivostok	NIA	NIA	1000	509	NIA	NIA
Transinfo	2012	Moscow	NIA	NIA	600	200	NIA	NIA
I-Teco	2012	Krasnoyarsk	NIA	NIA	120	40	NIA	NIA
Ikselereyt	2012	Moscow	NIA	NIA	580	200	NIA	NIA
Stack	2012	Kazan	$37 mln	NIA	NIA	376	2,5	NIA
Stack	2012	Moscow	NIA	NIA	250	30	NIA	NIA
Storedata	2012	Moscow	NIA	250	125	30	0,3	NIA
Rostelecom	2012	Sochi	1 bln. Rub	2000	400	92	NIA	NIA
Rostelecom	2012	Kaliningrad	33.5 mln. Rub	NIA	150	20	0,1	NIA
Megafone	2012	Orenburg	NIA	NIA	270	110	NIA	NIA
Fianco	2012	Krasnoyarsk	NIA	NIA	370	80	NIA	NIA
Fianco	2012	Ekaterinburg	NIA	NIA	56	12	NIA	NIA
Inoventica	2012	Tatarstan	NIA	NIA	300	60	NIA	NIA
Sberbank	2011	Moscow	$1.2 bln	16500	5000	1500	25	3
DataSpace	2011	Moscow	$85 mln	6000	3000	1000	4,8	3

Name	Year	City	Project cost	Total area, m²	Area of service platform, m²	Number of racks, pcs.	Power, MW	Level, Tier
Rostelecom	2011	Vladivostok	110 mln. Rub	320	100	15	1,2	3
Yandex	2011	Moscow	NIA	4500	NIA	NIA	8	NIA
Linxdatacenter	2011	St. Petersburg	20 mln. Euro	7500	NIA	250	NIA	3
KROK	2011	Moscow	$100 mln.	5000	2000	800	NIA	3
BSTelehouse	2011	Moscow	NIA	NIA	1000	75	NIA	NIA
Selektel	2011	St. Petersburg	NIA	NIA	800	250	NIA	NIA
Megafone	2011	Khabarovsk	NIA	NIA	390	50	NIA	NIA
TEL-Hosting	2011	Moscow	NIA	NIA	350	60	NIA	NIA
Permenergo	2011	Perm	14.6 mln. Rub	44	34	14	0,06	NIA
Bank "Neiva"	2011	Ekaterinburg	6.9 mln. Rub	34	25	4	0,04	NIA
OBIT	2011	St. Petersburg	15 mln. Rub	400	NIA	60	0,3	NIA
Bashneft	2011	Ufa	342.76 mln. Rub	400	NIA	NIA	0,56	3
Oversan Mercury	2010	Moscow	400 mln. Rub	950	500	200	4	3
Oversan Luna	2010	Moscow		NIA	120	50	0,5	NIA
Megaphone Samara	2010	Samara	930 mln. Rub	6912	2400	720	8	3
MDM-bank	2010	Moscow	100 mln. Rub	350	100	50	0,5	
Miran	2010	St. Petersburg	80 mln. Rub	NIA	NIA	100	3,5	3
Storedata	2010	Moscow	60 mln. Rub	NIA	250	100	1	NIA
Sibirtelecom	2009	Novosibirsk	124 mln. Rub	900	300	70	1,5	3
General DataComm	2009	St. Petersburg	$5 mln	2000	500	NIA	NIA	NIA
Komkor (Acad Telecom)	2009	Moscow	400 mln. Rub	NIA	NIA	140	NIA	NIA
Dataline	2009	MR - Korovin high road	NCA + 217.5 mln. Rub	NIA	2700	800	7	2
Dataline	2009	Moscow – Borovaya	NCA + 122 mln. Rub	1855	900	360	4	2
IT-park	2009	Kazan		3500	1000	294	5	3
Megafone (Synterra)	2009	Kazan	100 mln. Rub	229,5	170	48	0,5	NIA
PiN Telecom	2009	St. Petersburg	18 mln. Rub	200	NIA	38	NIA	NIA
ISG	2009		140 mln. Rub	700	NIA	150	3	NIA
Trastinfo	2009	Moscow	NCA + 176 mln. Rub	3000	1600	800	6,4	NIA
OKB Progress	2009	Moscow	NCA + 4 bln. Rub	480	480	100	NIA	NIA
Infobox	2009		NCA + 7.9 mln. Rub	NIA	600	NIA	25	NIA
Selektel	2009	Moscow	4.5-5 mln. US$	500	300	80	NIA	2
Uralsvyazinform	2009	Ekaterinburg	300 mln. Rub	NIA	432	250	NIA	NIA
Dataplanet	2009	Zelenograd	NCA + 9.8 mln. Rub	170	160	40	0,3	NIA
Raduga -2	2009	St. Petersburg	NCA + 2.2 mln. Rub	NIA	60	20	NIA	NIA
Rostelecom	2008	Ekaterinburg	10 mln. Rub	155	100	36	NIA	NIA
Troika Dialog	2008	Moscow	$10 mln	200	NIA	NIA	0,5	NIA
Peter-Service	2008		$20 mln	480	480	50	0,3	3
OBIT	2008	St. Petersburg	NCA + 10.1 mln. Rub	400	300	120	NIA	3
Selektel	2008	St. Petersburg	NCA +69.5 mln. Rub	1500	700	200	2	2
YUTK	2008		320 mln. Rub	1000	300	NIA	1,5	NIA
M1, Stack	2007	Moscow	$15 mln	2500	NIA	NIA	NIA	NIA
Tehnogorod	2007	Moscow	NCA + 10 mln. Rub	1500	NIA	NIA	1	3
Karavan	2008	Moscow	$7 mln	1000	NIA	NIA	2	NIA
Ixcellerate	2008		NIA	15000	6200	NIA	NIA	NIA
Zelenograd	2008	Zelenograd	3 bln. Rub	16000	14000	1215	21	3

In some projects, the abbreviation NCA is seen in the column “project cost”. This means that the project cost has not been revealed by the company, but when analyzing the data from the SPARK-Interfax system, an increase in value of the noncurrent assets (NCA) to include the specified amount can be found when constructing the data processing centers.

After collecting data on DPC construction projects, a procedure of adjusting them to a single currency (in our case the US dollar was selected) and prices of one year (2013 was selected) was carried out. This has been done using the price index for engines and equipment used in construction.

Unfortunately, in some cases data on projects was incomplete: for example, with the known cost of the construction and area of engineering sites, the number of racks was unknown. In such cases correlations identified in market research [8] and presented in *Table 3* were used for data recovery.

Table 3.

DPC market dynamics in 2011–2016

	2011	2012	2013	2014	2015	2016
Racks, ‘000 units	15.9	18.7	23.1	28.7	34.5	42.2
Area, ‘000 sq. m.	52.8	62.6	84.6	103.7	121.8	146.8
Sq. m. / rack	3.3	3.3	3.7	3.6	3.5	3.5

After processing, the original sample regression models were constructed with breakdown across DPC construction projects in Moscow and in the regions.

A planned DPC surface area (S) and planned number of racks (N) were selected as independent variables.

Capital costs (CAPEX) across all projects in Russia are determined by the following correlations:

1. CAPEX = –2856583 + 22136·S (in which case $R^2 = 0.72$; P-value for the coefficient of variable S is 4.7E-11. P-value of free constant is 0.76). Low P-value for the coefficient at variable S makes it possible to predictably say that the construction cost of one square meter (with a root-mean-square error of 2 339 dollars) is in the range between 19 797 and 24 475 dollars. This agrees with the expert assessments of 15–25,000 dollars [10].

2. CAPEX = –3375063 + 78751·N (in which case $R^2 = 0.8$; P-value for the coefficient of variable N is 2.03E-13, P-value of free constant is 0.67). With a root-mean-square error of the coefficient at N=, the construction cost in terms of a rack is in the range from 71 994 to 85 508 dollars. Therefore, the obtained construction cost of one rack is approximately 3.5 times higher than the construction cost of one square meter of DPC. This more or less equals the correlation obtained from marketing research.

To refine the cost, separate regression models depending on DPC location can be constructed:

✦ Moscow: CAPEX_Moscow = –2651754 + 22612·S or CAPEX_Moscow = –3315038 + 73616·N;

✦ Regions: CAPEX_Regions = –8077885 + 26586·S or CAPEX_Regions = –6171183 + 95935·N.

Summarizing the construction of regressional relationships and comparing the calculation results by a model with real data, one may conclude that the model rather suitably describes real data. Deviations of the estimated data from the averaged data for all selection of values are shown in *Table 4.*

Table 4.

Geographical segmentation DPC construction cost

DPC location	Moscow	Regions	Russia
Average cost of building 1 sq.m (aggregate CAPEX of sample / aggregate S)	19 686	22 890	22 291
Average cost of building 1 rack (aggregate CAPEX of sample / aggregate N)	62 080	85 400	80 407
Unit cost of building 1 sq.m (regression)	22 612	26 586	22 136
Unit cost of building 1 rack (regression)	73 616	95 935	78 751
Confidence interval – cost of building 1 sq.m (regression)	17 388 – 27 836	24 153 – 29 019	19 797 – 24 475
Confidence interval – cost of building 1 rack (regression)	59 201 – 88 031	93 366 – 98 502	71 994 – 85 508
Average surface area of DPC	1 583	1041	1258
Average number of DPC racks	509	242	349
Deviation of construction cost of 1 sq.m	13%	14%	-1%
Deviation of construction cost of 1 rack	16%	11%	-2%

A very interesting pattern can be derived from this table: the cost of DPC construction per 1 sq.m (or 1 rack) in Moscow is lower than in the regions by approximately 20%. This can be explained by the fact that the dimensions of a statistically average Moscow DPC exceed the dimensions of regional DPC by 80%, and with the project scaling-up the unit cost significantly goes down for each new rack or square meter.

These correlations can be used in evaluating the cost in the initial construction phase, and in the cost estimation for further development of the DPC, if it is foreseen.

Due to insufficient representativeness of the sample, it turned out to be impossible to include such parameters as Tier level and build time for the center in the regression model.

The impact of Tier level on the price of 1 sq.m can be taken into account by multiplying the CAPEX value on correction factor K_T, the values for which were obtained based on *Table 1*:

K_T = 0.8 for level Tier 2; K_T = 1 for level Tier 3; K_T = 1.8 for level Tier 4.

To take into account the price dynamics over time, the research results presented in paper [11] can be used. These show that the construction cost of 1 sq.m increases by approximately 30% per year.

Thus, the DPC construction cost in year G is determined by the ratio:

$$CAPEX_G = CAPEX \cdot K_T \cdot 1.3^{(G-2013)}.$$

3. Breakdown of DPC maintenance costs

Operating costs for DPC maintenance can be divided into five main groups:

1. Payment for power consumption. In calculating this parameter, one should rely not only on the value of kWh consumed by racks, but take into account the power consumption structure.

2. Rent of premises. This parameter depends heavily on the geographical location of the DPC and vary with time.

3. The payroll budget can depend heavily on the processing centers, irrespective of the level of reliability, on the basis of the operation continuity requirements.

4. Maintenance. The maintenance cost is determined by the composition of the systems used.

5. Other costs: appreciation of equipment, processing center insurance, etc.

Considering the research results of various companies, significant differences in the structure of operating costs of Russian and foreign processing centers should be noted. In particular, the Russian market is characterized by distribution of costs [1, 12, 13] presented in *Table 5*.

Table 5.

Structure of cost of Russian DPC composition

	Krok	Data-dom	CNews	Radius Group
Payment for electrical power	42%	25%	25%	42%
Rent of premises	9%	24%	20%	16%
Payroll budget	36%	40%	40%	35%
Maintenance	5%	11%	-	7%
Other costs	8%	-	15%	7%

American companies use a different structure of operating costs [9]. The difference is due to a different approach to clustering of costs subgroups among all operating costs, as well as the specifics of the Russian economy, in particular the wage gap, power cost and so on. Nevertheless, in all research the DPC maintenance cost includes expenses involved in electrical power (average 30%) and rent of premises. Typically, DPC maintenance cost also includes personnel costs and maintenance costs. Further articles of expense items for the processing center operation can differ widely.

The operating costs can be derived from the capital costs at the expense of such a key indicator as the DPC power, and subsequently based on the DPC power and power consumption costs.

From analysis of the power consumption structure in various centers [9, 12], it is apparent that the IT equipment used consumes about half of the power used by the data processing center. This means that all DPC racks consume power, and their cost is approximately 15% of all operating costs. At the moment, most DPC suse 5 kW racks for 42U, but the cost of 1 kWh of power in different regions differs widely.

Thus, let us assume that the operating costs are divided into five groups, each of which contributes to the overall cost:

1. Payment for power consumption (~ 30-35%).

2. Rent of premises (~ 15-20%).

3. Payroll budget (~ 25-30%).

4. Maintenance (~ 10-15%).

5. Other costs: appreciation of equipment, insurance, etc. (~ 10-15%).

To estimate the value of the operating costs, you can use a regression model. Before we start developing it, we have to highlight the main principles used to estimate these costs. Let us consider DPC power as a central variable for calculation, because:

✦ it can be quite accurately determined from the initially claimed technical characteristics (in particular, number of racks and DPC surface area)

✦ costs associated with the payment for electric power are the most notable group of the operating costs.

Thus, let us introduce new variables to generate regression enabling us to estimate the structure of the operating costs:

✧ OPEX – operating costs within a year, dollar

✧ M – DPC power, mW

✧ e – electrical power cost, doll./kW/h (different for each region of Russia).

Let us consider the relationship between the power of the processing center and its characteristics, having constructed appropriate regressions:

- $M = -0.17797 + 0.01192 \cdot N$ ($R^2 = 0.93$, P-value for the coefficient at N is 6.61E-16);
- $M = 0.24135 + 0.002671 \cdot S$ ($R^2 = 0.66$, P-value for the coefficient at S is 2.28E-07).

It is interesting that the specific power of each additional rack in DPC became 11.9 kW. Considering the fact that in the power consumption structure in-house equipment uses about 50% of all power, a generic rack in 42U has a power of 5 kW. This confirms the suitability of the data obtained.

As is clear from the regressions obtained, it is better to use the number of racks to assess the power. In assessing capital costs, it was proposed to build separate regressions for Moscow, the regions and Russia as a whole. In this case, it is inexpedient because such a key index (except for DPC power), as the cost of electrical power is significantly different for each Russian region and should be chosen separately.

In summary, proceeding from the previous analysis of the operating cost structure (about 30% OPEX is accounted for by electric power), the assessment can be conducted by the following formula:

$OPEX = M \cdot [365 \text{ days}] \cdot [24 \text{ hours}] \cdot e/0.3$ or

$OPEX = (-0.17797 + 0.01192 \cdot N) \cdot 29200 \cdot e/0,3$

$OPEX = (0.24135 + 0.002671 \cdot S) \cdot 29200 \cdot e/0.3.$

Conclusion

Obviously, all data processing centers differ from each other. Thus, there is no multipurpose tool which could exactly calculate money flows. The proposed procedure makes it possible with appropriate accuracy to estimate the characteristics of data processing center development projects. ■

References

1. Radius Group (2012) *Ekonomika TsOD* [Economics of data centers]. Available at: http://www.rvip.ru/1065/document1071.shtml#5 (accessed 1 June 2016) (in Russian).
2. Patel C.D., Shah A.J. (2005) Cost model for planning, development and operation of a data center. *Internet Systems and Storage Laboratory – HP Laboratories Palo Alto*. Available at: http://www.hpl.hp.com/techreports/2005/HPL-2005-107R1.pdf (accessed 1 June 2016).
3. Hamilton J. (2010) Overall data center costs. *Perspectives. James Hamilton's Blog*. Available at: http://perspectives.mvdirona.com/2010/09/18/OverallDataCenterCosts.aspx (accessed 1 June 2016).
4. Lebedev P. *Kommercheskie TsOD v Rossii: smena biznes-modeli* [Commercial data centers in Russia: Shift of business model]. CNews. Available at: http://www.cnews.ru/reviews/free/cloud/articles/articles13.shtml (accessed 1 June 2016) (in Russian).
5. Comprice (2012) *Obzor rynka datatsentrov Sankt-Peterburga v I polugodii 2012 g.* [The review of the market data center of St. Petersburg in the first half of 2012]. Available at: http://www.comprice.ru/articles/detail.php?ID=475362&print=true (accessed 1 June 2016) (in Russian).
6. TelecomBloger (2013) *Osobennosti postroeniya nebol'shogo datatsentra v Moskve* [Features build a small datacenter in Moscow]. Available at: http://telecombloger.ru/14535 (accessed 1 June 2016) (in Russian).
7. Sukhov R. (2008) Kak rasschitat' zatraty na TsOD? [How to calculate the cost of the data center?]. *Zhurnal setevykh resheniy LAN* (electronic journal), no. 04. Available at: http://www.osp.ru/nets/2008/04/4944787/ (accessed 1 June 2016) (in Russian).
8. Pavlov A., Basistyy D., Kusakin D. (2012) Biznes-plan i finansovaya otsenka sozdaniya TsODa vysokogo urovnya nadezhnosti [Business plan and financial evaluation of establishing a data center a high level of reliability]. *iKS-Media*. Available at: http://www.iks-media.ru/issue/2012/7/4430815.html (accessed 1 June 2016) (in Russian).
9. AboutDC (2011) *Statistika TsOD* [Statistics of data centers]. Available at: http://aboutdc.ru/page/64.php AboutDC.ru (accessed 1 June 2016) (in Russian).
10. IT Weekly (2013) *Data-tsentry rastut kak griby...* [Data centers are growing like mushrooms...]. Available at: http://www.it-weekly.ru/analytics/tech/45540.html (accessed 1 June 2016) (in Russian).
11. Orlov S. (2008) TsOD: rossiyskaya spetsifika [Data center: Russian specificity]. *Zhurnal setevykh resheniy LAN* (electronic journal), no. 09. Available at: http://www.osp.ru/lan/2008/09/5535759/ (accessed 1 June 2016) (in Russian).
12. Pavlov A. (2008) *Inzhenernye resheniya, ispol'zuemye dlya snizheniya zatrat pri ekspluatatsii TsOD* [Engineering solutions used to reduce costs of a data center]. Open Systems. Available at: http://www.osp.ru/data/670/942/1238/10.pdf (accessed 1 June 2016) (in Russian).
13. Gabrielyan V. (2009) *Kak postroit' sobstvennyy TsOD* [How to build your own data center]. Byte Russia. Available at: http://www.bytemag.ru/articles/detail.php?ID=15495 (accessed 1 June 2016) (in Russian).

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Аннотация

В современных условиях наблюдается рост спроса на услуги ИТ-аутсорсинга, что влечет за собой активизацию процессов проектирования и строительства центров обработки данных (ЦОД). Поскольку ЦОД представляет собой сложную и дорогостоящую систему, возникает задача обоснованного выбора будущего проекта на основе показателей оценки затрат, которые могут возникнуть на этапе проектирования и эксплуатации центров обработки данных.

В работе анализируется один из возможных комплексов показателей для оценки затрат на создание и эксплуатацию центров обработки данных. В процессе анализа выявлены основные группы капитальных затрат при создании ЦОД, которые не в полной мере учитывались при оценке суммарного объема капитальных вложений по ранее предлагаемым методикам. В статье предложены регрессионные модели оценки проекта строительства центра обработки по двум показателям. Предложено оценивать капитальные затраты в зависимости от проектируемой площади технических площадок и от проектируемого количества стоек серверов. На основе разработанных моделей проведен анализ строительных площадок центров обработки данных, который показал адекватность модели реальным данным. Были установлены основные группы операционных затрат на содержание ЦОД и предложена регрессионная модель их оценки. На основе регрессионного уравнения предлагается рассчитывать мощность центра обработки в зависимости от площади технической площадки или количества стоек серверов. Стоимость эксплуатации центра обработки данных определяется, исходя из величины мощности. Анализ информации о стоимости эксплуатации различных центров обработки данных достаточно хорошо согласуется с расчетами, полученными на основе разработанной модели.

Предложенные модели позволяют с приемлемой точностью оценить характеристики проекта создания и последующей эксплуатации центра обработки данных.

Ключевые слова: центр обработки данных, регрессионная модель, строительство, репрезентативности выборки, структура затрат, операционные затраты, капитальные затраты.

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Литература

1. Экономика ЦОД // Radius Group. [Электронный ресурс]: http://www.rvip.ru/1065/document1071.shtml#5 (дата обращения 01.06.2016).
2. Patel C.D., Shah A.J. Cost model for planning, development and operation of a data center // Internet Systems and Storage Laboratory – HP Laboratories Palo Alto. [Электронный ресурс]: http://www.hpl.hp.com/techreports/2005/HPL-2005-107R1.pdf (дата обращения 01.06.2016).
3. Hamilton J. Overall data center costs // Perspectives. James Hamilton's Blog. [Электронный ресурс]: http://perspectives.mvdirona.com/2010/09/18/OverallDataCenterCosts.aspx (дата обращения 01.06.2016).
4. Лебедев П. Коммерческие ЦОД в России: смена бизнес-модели // CNews. [Электронный ресурс]: http://www.cnews.ru/reviews/free/cloud/articles/articles13.shtml (дата обращения 01.06.2016).
5. Обзор рынка датацентров Санкт-Петербурга в I полугодии 2012 г. // Comprice.ru. [Электронный ресурс]: http://www.comprice.ru/articles/detail.php?ID=475362&print=true (дата обращения 01.06.2016).
6. Особенности построения небольшого датацентра в Москве // telecombloger.ru. [Электронный ресурс]: http://telecombloger.ru/14535 (дата обращения 01.06.2016).
7. Сухов Р. Как рассчитать затраты на ЦОД? // Журнал сетевых решений LAN. 2008. № 04. [Электронный ресурс]: http://www.osp.ru/nets/2008/04/4944787/ (дата обращения 01.06.2016).
8. Павлов А., Басистый Д., Кусакин Д. Бизнес-план и финансовая оценка создания ЦОДа высокого уровня надежности // iKS-Media. [Электронный ресурс]: http://www.iks-media.ru/issue/2012/7/4430815.html (дата обращения 01.06.2016).
9. Статистика ЦОД // AboutDC.ru. [Электронный ресурс]: http://aboutdc.ru/page/64.php (дата обращения 01.06.2016).
10. Data-центры растут как грибы... // it-weekly.ru. [Электронный ресурс]: http://www.it-weekly.ru/analytics/tech/45540.html (дата обращения 01.06.2016).
11. Орлов С. ЦОД: российская специфика // Журнал сетевых решений LAN. 2008. № 09. [Электронный ресурс]: http://www.osp.ru/lan/2008/09/5535759/ (дата обращения 01.06.2016).
12. Павлов А. Инженерные решения, используемые для снижения затрат при эксплуатации ЦОД // Открытые системы [Электронный ресурс]: http://www.osp.ru/data/670/942/1238/10.pdf (дата обращения 01.06.2016).
13. Габриелян В. Как построить собственный ЦОД // Byte Россия. [Электронный ресурс]: http://www.bytemag.ru/articles/detail.php?ID=15495 (дата обращения 01.06.2016).