CHANGE IN THE BUSINESS MODEL FOR MANAGING THE ACTIVITIES OF IT ENTERPRISES IN CONNECTION WITH THE DEVELOPMENT OF A SERVICE-ORIENTED INFORMATION ECONOMY

MUDANÇA NO MODELO DE NEGÓCIO PARA GESTÃO DAS ATIVIDADES DAS EMPRESAS DE TI NO DESENVOLVIMENTO DE UMA ECONOMIA DA INFORMAÇÃO ORIENTADA A SERVIÇOS

CAMBIO EN EL MODELO DE NEGOCIO PARA LA GESTIÓN DE LAS ACTIVIDADES DE LAS EMPRESAS TI EN RELACIÓN CON EL DESARROLLO DE UNA ECONOMÍA DE LA INFORMACIÓN ORIENTADA A LOS SERVICIOS

Vladimir Biryukov
Moscow Polytechnic University, Russia
http://orcid.org/0000-0002-2580-5927

Irina Shchetinina
Russian State University of Tourism and Service
http://orcid.org/0000-0001-9766-4265

Oksana Konnova
Russian State University of Tourism and Service
http://orcid.org/0000-0002-3230-5277

Mariya Klimenkova
MIREA - Russian Technological University (RTU MIREA)
http://orcid.org/0000-0002-2515-6453

Elena Kryukova
Russian State Social University
http://orcid.org/0000-0002-3734-7206

Dmitriy Ryakhovsky
Financial University under the Government of the Russian Federation
http://orcid.org/0000-0002-3459-9184

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Abstract
The purpose of the study is to substantiate scientific, methodological, and practical recommendations for optimizing the economic and organizational business model of enterprises developing information technologies to increase competitive advantages. The article defines the main economic and organizational models for 13 information technology development enterprises (IT enterprises), clusters have been calculated and discrepancies between them have been established. The need to improve management models of IT enterprises has been identified based on cluster analysis. An integral indicator for evaluating the efficiency of economic and organizational support of IT enterprises has been proposed. It has been revealed that the integral indicator of economic and organizational support allows comparing an IT enterprise with competitors. It has been proved that cluster analysis and calculation of the integral indicator of economic and organizational support make it possible to identify IT enterprises that need to change the business model of management.

Keywords: IT enterprise, cluster analysis, an integral indicator for evaluating the effectiveness of economic and organizational support.

Resumo
O objetivo do estudo é fundamentar recomendações científicas, metodológicas e práticas para otimizar o modelo de negócios econômico e organizacional das empresas que desenvolvem tecnologias da informação para aumentar as vantagens competitivas. O artigo define os principais modelos econômicos e organizacionais para 13 empresas de desenvolvimento de tecnologia da informação (empresas de TI), foram calculados clusters e estabelecidas discrepâncias entre eles. A necessidade de melhorar os modelos de gestão das empresas de TI foi identificada com base na análise de clusters. Foi proposto um indicador integral para avaliar a eficiência do suporte econômico e organizacional das empresas de TI. Foi revelado que o indicador integral de suporte econômico e organizacional permite comparar uma empresa de TI com os concorrentes. Comprovou-se que a análise de clusters e o cálculo do indicador integral de suporte econômico e organizacional permitem identificar empresas de TI que precisam mudar o modelo de gestão do negócio.

Palavras-chave: empresa de TI, análise de cluster, um indicador integral para avaliar a eficácia do suporte econômico e organizacional.

Resumen
El propósito del estudio es fundamentar recomendaciones científicas, metodológicas y prácticas para optimizar el modelo de negocios económico y organizacional de las empresas que desarrollan tecnologías de la información para aumentar las ventajas competitivas. El artículo define los principales modelos económicos y organizativos para 13 empresas de desarrollo de tecnologías de la información (empresas de TI), se han calculado clústeres y se han establecido discrepancias entre ellos. La necesidad de mejorar los modelos de gestión de las empresas de TI se ha identificado con base en el análisis de conglomerados. Se ha propuesto un indicador integral para evaluar la eficiencia del soporte económico y organizacional de las empresas de TI. Se ha revelado que el indicador integral de apoyo económico y organizacional permite comparar una empresa de TI con sus competidores. Se ha comprobado que el análisis de

conglomerados y el cálculo del indicador integral de apoyo económico y organizacional permiten identificar empresas de TI que necesitan cambiar el modelo de gestión empresarial.

Palabras clave: empresa de TI, análisis de conglomerados, un indicador integral para evaluar la eficacia del apoyo económico y organizacional.

1. INTRODUCTION

It is necessary to understand the essence of the processes that occur in this industry for effective management of information technology development enterprises (IT enterprises). The possibility of rapid distribution and reproduction of successful solutions by competitors increases the risk of competition from new players (Zakharov et al., 2022; Panasenko et al., 2021). Combined innovations (Guimarães, Severo & Dorion, 2022) prevail among the newly created ones, the complexity of projects increases, and the time of their implementation decreases (Markova et al., 2021). The immaterial nature of information technologies allows them to spread quickly via the Internet, so modern IT enterprises operate in conditions of constant changes: market conditions, customer wishes, information technologies, and business models (Teece, 2018; Kiseleva et al., 2017). In the field of information technology, IT enterprises are the first to encounter the field of the unknown, intuitively or accidentally searching for individual solutions. One of the problems of the IT industry is the presence of poorly structured problems, since uncertain patterns, dependencies, characteristics, and signs dominate, which leads to the impossibility or difficulty of quantifying performance indicators (Ben Romdhane Ladib & Lakhal, 2015; Hernández de Velazco et al., 2009).

The activities of enterprises operating in the IT sector are very diverse: the provision of telecommunications services (Kravets et al., 2021), the production of equipment, software development (Usmanova et al., 2021), the sale of equipment and software, and the provision of IT services.

Modern IT enterprises differ among themselves in size, degree of organizational development, and maturity of processes, therefore it is impossible to choose a uniform for all, that is, a unified management approach (Zalewska-Kurek et al., 2017). In addition, the possibility of rapid changes in the IT industry makes it necessary to build variations of the

existing business model and compare their effectiveness (Löfsten, 2016; Veselovsky et al., 2019). Therefore, the study of the problems of creating and improving business models for managing the activities of IT enterprises is of the utmost importance.

2. RESEARCH ANALYSIS

By definition (Demil & Lecocq, 2010), a business model is a conceptual tool that includes a set of elements and their relationships and allows seeing the logic of how a company makes money. According to (Christensen, Bartman & Van Bever, 2016), business models are considered as new units of analysis, they are used to describe how companies conduct their business, and, finally, how value is created, and not only how this value is preserved and multiplied. According to (Bouwman et al., 2020), the business model determines who your customers are, what you sell, how the offer is formed, and why your business makes a profit.

The study (Groesser & Jovy, 2016) defines the difference between the business model and the strategy as follows: the business model is focused on creating value for the client, and the strategy is focused on creating value for shareholders (for this reason, the issue of financing the company is often poorly emphasized in the business model). The strategy is mainly focused on positioning the company relative to its competitors, while the business model is focused on the structure of exchange transactions with external entities and related factor markets. According to (Ziaee Bigdeli et al., 2016), a business model is a business layout, and a strategy is a specific document for achieving the goals set for the enterprise. The process of developing a business model is part of the business strategy. Therewith, firstly it is necessary to develop one or several different business models, and then, following the chosen one, develop a strategy.

In the practice of business modeling, the creation of models of the current ("as is") and desired ("as it should be") state is used, followed by planning the transition from the current state to the desired one (Euchner & Ganguly, 2014). A new business model can be unique, or created based on "best practices", that is, repeat one of the most successful business models in the industry (Zott, Amit & Massa, 2011). According to J. Magretta (2002), the use of "best practices" can lead to a simple increase in operational efficiency, however, due to the possibility of rapid copying by competitors, it will not provide a long-term competitive advantage.

However, this may lead to the streamlining of business processes (Foss & Saebi, 2017), which, in turn, will increase the potential for further improvement of management (Clauss, 2017).

Researchers (Rydehell & Isaksson, 2016) note that an enterprise can improve a product, process, or business model. Although in modern conditions, due to globalization, competition and commoditization, it is no longer possible to limit oneself only to an innovative product or process, international corporations invest no more than 10% of the innovation budget in real business model developments (Gronum, Steen & Verreynne, 2016). As noted in (Foss & Saebi, 2015), competition is always dynamic and even large companies can become due to the inability to change. A successful business model can help new players quickly take a leading position in the market: for example, Apple, due to iTunes, has become the world's largest seller of music recordings, despite the presence of major players on the market like Universal, Warner, BMG, Sony, EMI (Bouwman et al., 2018). According to (Teece & Linden, 2017), now companies are competing at the level of business models, and not for a product because it is changing and improving rapidly.

The improvement of the business model with a certain management principle (Andrade, Andrade de Abreu, Santos & Khatib, 2022) can occur in two ways: without changing the management principles, with minimal changes in the enterprise (Kujala et al., 2011).

Thus, the speed of changes in the IT sector entails a shift in emphasis from improving the management of IT enterprises to improving their business models.

The purpose of the study is to substantiate scientific, methodological, and practical recommendations for optimizing the economic and organizational business model of enterprises developing information technologies to increase competitive advantages.

The achievement of this goal led to the solution of the following tasks:

- to systematize approaches to IT enterprise management;
- to conceptualize tools for building economic and organizational models of IT enterprises;
- to carry out clustering of IT enterprises according to the indicators of economic and organizational support;
- to determine the effectiveness of economic and organizational support and justify the need to change the business model of managing the activities of an IT enterprise.

Research hypothesis: the cluster analysis and calculation of the integral indicator of economic and organizational support make it possible to identify IT enterprises that need to change the business model of management.

3. METHODS

General scientific and special methods were used in the course of the research: synthesis and comparative analysis (to study approaches to IT enterprise management and the current state of IT entrepreneurship); logical (in the analysis of IT enterprise management tools); cluster analysis (to determine the similarity of IT enterprises).

The information base of the study consists of scientific literature and statistical data of reporting of IT enterprises.

The assessment of economic and organizational support was carried out for 13 IT enterprises that agreed to provide information about their activities or publish annual reports (Table 1) for 2021 according to the following indicators: X1 – the average number of employees, people; X2 – labor costs, thousand rubles; X3 – proceeds from sales, thousand rubles; X4 – operating expenses, thousand rubles; X5 – administrative expenses, thousand rubles; X6 – sales expenses, thousand rubles; X7 – net financial result, thousand rubles; X8 – intangible assets, thousand rubles; X9 – the volume of acquisition of non-current assets, thousand rubles. The advantage of these indicators is their measurability.

The study considered only IT enterprises that develop software and provide IT services. The enterprises were selected so that they represented typical IT enterprises with up to 80 employees.

Further, based on the initial data (Table 1) with the help of the R programming language, the solution to the cluster analysis problem was carried out, which consists of a classification breakdown. The number of clusters was found using the k-means clustering.

Further, to more accurately determine the differences between clusters, it is necessary to estimate their distance. The k-means clustering is suitable to solve this problem, which was used to calculate the number of clusters. According to this method, the average values of each indicator are calculated for each cluster.

To ensure comparability, the data for each indicator were normalized according to the following formula: $\mathbf{(x_i - x_{av})/s}$, where x_i is the i-uo indicator value of the cluster, i = 1...n; x_{av} is the average value of the indicator; n is the number of clusters; s is the standard deviation.

Effective management of IT enterprises is impossible without a quantitative assessment of performance indicators. The indicators of economic and organizational support of IT enterprises were divided into two groups to assess their effectiveness: indicators of economic support and organizational support.

The indicators of economic support include X2 – labor costs, thousand rubles; X3 – proceeds from sales, thousand rubles; X4 – operating expenses, thousand rubles; X7 – net financial result, thousand rubles; X9 – the volume of acquisition of non-current assets, thousand rubles.

Organizational support indicators include X1 – the average number of employees, people; X5 – administrative expenses, thousand rubles; X6 – sales expenses, thousand rubles; X8 – intangible assets, thousand rubles.

The analysis of indicators by groups is a necessary prerequisite for calculating the generalizing integral indicator of the economic and organizational support of the IT enterprise Int_{eoo} according to the following formula: $\mathbf{Int_{eoo} = (Int_e + Int_o)/2}$, where Int_e is an integral indicator of economic support; Int_o is an integral indicator of organizational support.

To be able to compare indicators that are in different ranges and have different units of measurement, it is necessary to make them homogeneous. Given the impracticability of prioritizing indicators, we consider them equivalent. Therefore, the integral indicators of economic and organizational support are calculated according to the normalized values according to the following formula:

$$Iht_i = \frac{1}{m} \cdot \sum_{j=1}^{m} \frac{x_{ij} - x_j min}{x_j max - x_j min}$$

where x_{ij} is the value of the *j*-th indicator for the *i*-th enterprise, i = 1... n, j = 1... m;

n – the number of enterprises; m – the number of indicators in the group;

$x_{j\,min}$, $x_{j\,max}$ – respectively the minimum and maximum values of the *j*-th indicator.

Based on the calculation of the integral indicator, the efficiency of economic and organizational support of the analyzed enterprises is determined. Integral indicators for clusters of IT enterprises are calculated in the same way. The scale of the integral indicator of economic and organizational support is provided by four levels:

High – $\mathbf{Int}_{eoo} \in [0,75; 1,00]$.

Medium – $\mathbf{Int}_{eoo} \in [0,50; 0,74]$.

Low – $\mathbf{Int}_{eoo} \in [0,25; 0,49]$.

Weak – $\mathbf{Int}_{eoo} \in [0,00; 0,24]$.

4. Results

The assessment of the economic and organizational support of IT enterprises is presented in Table 1.

Table 1

Indicators of economic and organizational support of IT enterprises

No.	Economic entities	X1	X2	X3	X4	X5	X6	X7	X8	X9
1	Enterprise 1	5	49	484	427	416	-	294	9	-
2	Enterprise 2	5	423	1,302	918	52	35	30	11	-
3	Enterprise 3	6	309	-	455	421	-	1	22	-
4	Enterprise 4	34	1,282	1,782	25,632	5,085	1,717	61	62	536
5	Enterprise 5	58	18,830	46,848	38,725	6,758	187	11,005	1,518	605
6	Enterprise 6	2	107	-	176	176	-	-177	50,592	-
7	Enterprise 7	10	51	182	416	152	-	4	49,557	-
8	Enterprise 8	4	305	-	467	433	-	1	19	-
9	Enterprise 9	69	18,786	48,091	38,082	13,323	1	3,893	13	220
10	Enterprise 10	15	907	3,005	2,201	135	98	113	36	-
11	Enterprise 11	6	302	-	457	421	-	1	19	-
12	Enterprise 12	4	315	-	429	426	-	9	18	-
13	Enterprise 13	10	182	5,248	1,893	1,312	-	14	-	-

Source: research data, 2022

As can be seen from Table 1, nine of the selected enterprises have up to ten employees. As the results of the subsequent cluster analysis showed, it is optimal to divide the analyzed enterprises into four clusters (Table 2).

Table 2

The importance of indicators of IT enterprise clusters

Cluster	Economic entities		X1	X2	X3	X4	X5	X6	X7	X8	X9
Cluster 1	Enterprise 10		15	907	3,005	2,201	135	98	113	36	-
	Enterprise 13		10	182	5,248	1,893	1,312	-	14	-	-
	Enterprise 12		4	315	-	429	426	-	9	18	-
	Enterprise 8		4	305	-	467	433	-	1	19	-
	Enterprise 11		6	302	-	457	421	-	1	19	-
	Enterprise 3		6	309	-	455	421	-	1	22	-
	Enterprise 1		5	49	484	427	416	-	294	9	-
	Enterprise 2		5	423	1,302	918	52	35	30	11	-
	Average values		6.9	348.8	1,254.8	781.0	452.0	16.6	58.9	16.9	0.0
Cluster 2	Enterprise 7		10	51	182	416	152	-	4	49,557	-
	Enterprise 6		2	107	-	176	176	-	-177	50,592	-
	Average values		6.0	79.5	91.0	296.0	165.0	0.0	-86.5	50,073	0.0
Cluster 3	Enterprise 9		69	18,786	48,091	38,082	13,323	1	3,893	13	220
	Enterprise 5		58	18,830	46,848	38,725	6,758	187	11,005	1,518	605
	Average values		63.5	18,814	47,470	38,403	10,042	94.5	7,450.0	766	413
	Enterprise 4		34	1,282	1,782	25,632	5,085	1,717	61	62	536

Source: research data, 2022

Thus, the definition of the cluster structure made it possible to group IT enterprises according to similar characteristics using hierarchical clustering.

Normalized average values of indicators for clusters are shown in Table 3

Table 3

Normalized average values of indicators for clusters

Cluster	X1	X2		X3	X4	X5	X6	X7	X8	X9
Cluster 1	-0.564	-0.565		-0.556	-0.563	-0.552	-0.405	-0.560	-0.590	-0.577
Cluster 2	-0.591	-0.590		-0.599	-0.591	-0.603	-0.734	-0.594	1.155	-0.577
Cluster 3	1.155	1.155		1.154	1.155	1.154	1.139	1.155	-0.564	1.155

Source: research data, 2022

The values of integral indicators of the analyzed IT enterprises and their cluster formations are presented in Table 4.

Table 4
Integral indicators for the analyzed enterprises

No.	Economic entities	Int_e	Int_o	Int_{eoo}
By enterprises				
1	Enterprise 1	0.012	0.018	0.015
2	Enterprise 2	0.017	0.016	0.017
3	Enterprise 3	0.007	0.022	0.015
4	Enterprise 4	0.334	0.465	0.399
5	Enterprise 5	0.995	0.370	0.683
6	Enterprise 6	0.001	0.252	0.127
7	Enterprise 7	0.005	0.277	0.141
8	Enterprise 8	0.007	0.015	0.011
9	Enterprise 9	0.742	0.500	0.621
10	Enterprise 10	0.037	0.065	0.051
11	Enterprise 11	0.007	0.022	0.015
12	Enterprise 12	0.007	0.015	0.011
13	Enterprise 13	0.036	0.054	0.045
By cluster formations				
1	Cluster 1	0.015	0.055	0.035
2	Cluster 2	0.000	0.250	0.125
3	Cluster 3	1.000	0.754	0.877

Source: research data, 2022

Thus, as a result of cluster analysis, it was revealed that the IT enterprises of the first cluster most need to change the business model of management.

5. DISCUSSION

Cluster formations were discovered during the clustering of IT enterprises with a staff of up to eighty people. According to the results of the study, three cluster formations were identified (Table 2). As the results of cluster analysis have shown, eight IT enterprises are grouped into the first cluster. All IT enterprises included in the first cluster have a staff of fewer than 20 employees and an insignificant value of intangible assets. They have no expenses for the acquisition of non-current assets for 2021. The vast majority of IT enterprises in the first cluster have no sales costs, and administrative costs exceed labor costs. The overwhelming number of IT enterprises in the first cluster has a low net financial result. Thus, IT enterprises of the first cluster need to improve management to reduce unproductive costs.

The second cluster includes two IT enterprises that have the main features inherent in the enterprises of the first cluster. However, unlike the enterprises of the first cluster, they have more moderate administrative costs and significantly larger intangible assets. Thus, the IT enterprises of the second cluster, although they need to improve management, however, have a noticeably better position compared to the first cluster.

The third cluster includes two IT enterprises. The main differences between the first two clusters are a significantly larger volume of proceeds from sales, net profit, acquisition of non-current assets in 2021, as well as a larger staff. Thus, the IT enterprises of the third cluster are more efficient than the first and second ones.

One IT enterprise (Enterprise 4) was not included in any cluster. It has the largest indicator of sales expenses among all the analyzed enterprises, in terms of the number of administrative expenses incurred, it is comparable with the enterprises of the third cluster, in terms of labor costs per employee and net profit – with the enterprises of the first and second cluster.

According to the results of the study of differences between clusters by the k-means clustering (Table 3), the main differences between the first and second clusters are the presence of significantly larger intangible assets and lower sales costs in the second cluster. The third cluster differs significantly from the first two, but in terms of intangible assets, it is similar to the first one.

As can be seen from Table 4, the enterprises of the third cluster have a high level of both economic and organizational support, and the enterprises of the first and second clusters differ in integral indicators of organizational support. Therewith, the first cluster has weak economic and organizational support. The second cluster has economic support worse than the first cluster, but organizational support is better.

A comparison of the analyzed IT enterprises of the first cluster by integral indicators of economic and organizational support (Table 4) showed that Enterprise 8 and Enterprise 12 have the worst economic and organizational support from the enterprises of the first cluster. Enterprise 10 has the best indicators relative to the first cluster, but weak concerning all

analyzed enterprises. Thus the integral indicator of economic and organizational support allows for comparing an IT enterprise with competitors.

Changes in the business model of management require, firstly, enterprises of the first cluster, secondly – the second, and lastly – the third.

The need for regular changes in the business model of management of IT enterprises due to constant changes in the IT field is postulated by many researchers (Zott et al., 2011; Gronum et al., 2016). Researchers (Rydehell, Isaksson, 2016; Biryukov et al., 2021) note that enterprises can either use one of the existing business models, or develop a new one due to globalization and increased competition, and, as a consequence, the rapid spread of innovations in the IT market. Therewith, modeling will allow comparing the variants of changes that can be introduced at the enterprise, provided that the company's strategy remains unchanged (Groesser, Jovy, 2016). The comparison criteria may be the amount of necessary funding, the duration of the transition to a given state, and the like. While a balanced scorecard is used to monitor the achievement of strategic goals, modeling will allow comparing and justifying ways to achieve these goals.

6. CONCLUSION

The article defines the main economic and organizational models for 13 IT enterprises with fewer than 80 employees. Clusters have been calculated and discrepancies between them have been established. The advantage of the indicators used in clustering is their measurability. The distribution of IT enterprises into clusters made it possible to assess the state of the enterprise in comparison with other IT enterprises and determine the need for management improvement.

An integral indicator for evaluating the efficiency of economic and organizational support of IT enterprises has been proposed. It has been revealed that the integral indicator of economic and organizational support allows comparing an IT enterprise with competitors.

It has been proved that cluster analysis and calculation of the integral indicator of economic and organizational support make it possible to identify IT enterprises that need to change the business model of management.

The limitations of the study include the limited scope of the IT enterprises analyzed in the study (software development and provision of IT services).

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