

Analysis of the potential for the implementation of ICT in enterprises, taking into account the factor «business conditions»

Análisis del potencial para la implementación de las TIC en las empresas, teniendo en cuenta el factor «condiciones comerciales»

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Abstract

The article identifies promising approaches to assessing the information technology needs of enterprise management in ICT using the cost-benefit method. To identify the investment potential of the technologies being introduced, the main factors are identified (using strategic analysis methods: SWOT analysis, PEST analysis) that determine the potential for ICT development, which are designed to satisfy current and future information and technological needs of enterprise management. Based on empirical data obtained from an anonymous survey of representatives of the business community, the article determines the degree of effectiveness of ICT implementation at enterprises in a particular region, taking into account the factor "business conditions".

Key words: ICT, investment potential, factor "business conditions", strategic analysis

Resumen

El artículo identifica enfoques prometedores para evaluar las necesidades de tecnología de la información de la gestión empresarial en las TIC utilizando el método de costo-beneficio. Para identificar el potencial de inversión de las tecnologías que se están introduciendo, se identifican los factores principales (utilizando métodos de análisis estratégico: análisis DAFO, análisis PEST) que determinan el potencial para el desarrollo de las TIC, que están diseñados para satisfacer la información actual y futura y las necesidades tecnológicas de la gestión empresarial. Basado en datos empíricos obtenidos de una encuesta anónima de representantes de la comunidad empresarial, el artículo determina el grado de efectividad de la implementación de las TIC en las empresas de una región en particular, teniendo en cuenta el factor "condiciones comerciales".

Palabras clave: TIC, potencial de inversión, factor "condiciones comerciales", análisis estratégico

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1. Introduction

In the domestic market of information and telecommunication technologies, demand for two main groups of consumers dominates. The first group includes information and communication technology (ICT) companies, and the second includes manufacturing enterprises that are consumers of the services that the first group provides.

The existing size and structure of the market is provided: on the one hand, by the demand for ICT from four major groups of customers. A significant role for the market is formed by orders of structures affiliated with the public sector. Traditional demand is provided by a limited number of giants of the economy, who usually order large-scale expensive ICT projects ranging from \$1-2 million to several tens of millions of dollars. Such a rather significant amount is provided mainly by structures like Lukoil, TNK, Gazprom, etc.

A steady demand belongs to enterprises and organizations that order not very expensive ICT projects, the cost of each of which does not reach 1 million dollars. Indeed, the massive demand for ICT among organizations at this level belongs to trading companies, banks, and service companies.

The last, largest, but least solvent group of consumers includes enterprises that focus on low-cost information system products of domestic manufacturers. It is based on information systems for 30-50 workplaces worth 50-100 thousand dollars.

2. Literature review

In general, ICT is one of the reasons that ensures the economic competitiveness of business in the modern world. In addition, they affect:

- 1) operational adaptation to changes (by technology, consumer preferences);
- 2) the quality of the products and services provided;
- 3) overcoming trade barriers (Tarute & Gatautis, 2014).

In addition, ICTs act as a serious competitive advantage in improving the quality of manufactured products and services. These technologies can be used at all stages of the product life cycle:

- 1) at the design stage - using automated systems for design and modeling (for example, AutoDESK) and data storage in the form of electronic documents;
- 2) at the stage of supply and production - through improved logistics planning, as well as automatic control of the shelf life of products;
- 3) during storage and transportation - through improved logistics planning, as well as automatic control of the shelf life of products;
- 4) upon implementation - using an automated service for registering complaints and suggestions from contractors.

In accordance with the results of a study of the impact of ICT on the development of small and medium-sized capitalization enterprises in Greece, the activities of more than 3,500 medium and small enterprises were analyzed in order to determine the effectiveness of ICT implementation in the economic activities of these organizations (Giotopoulos, Konyolaimou, Korra & Konyolaimou, 2017). The study was based on the following categories:

- ICT implementation process;

- the state of ICT infrastructure in the enterprise;
- the process of integration on the Internet;
- state of electronic sales;
- the number of electronic purchases.

The results of the study showed that the benefits of introducing ICTs in innovative development, productivity, integration into the world market, and the growth of economic potential are quite noticeable in the entire sector of the economy, as well as among small organizations. The authors of the study point to the growth of innovative developments or to joint cooperation on such developments among the leaders of small and medium enterprises in the implementation of ICT. It should be noted that the presence of a large percentage of workers with professional skills in the ICT sector can positively affect the development process of the company in the field of new technologies.

In particular, a study conducted in Mexico based on 288 small and medium-sized enterprises considers the role of ICT in order to increase the competitiveness of enterprises in the market (Cuevas-Vargas, Estrada & Larios-Gomez, 2016). The study concludes that when using ICT as an important factor in innovation, especially in small and medium-sized companies, the quality of products, production processes and management methods is improved. Thanks to this, companies are able to maintain competitiveness by improving organizational, financial and personnel performance. The authors also found that the process of effective use of ICT positively affects the overall level of effectiveness of such organizations. Therefore, companies need to take into account modern achievements and technologies in the formation of a business strategy, production optimization, as well as in management.

The article, which describes the relationship between ICT development and Singapore's economic growth, clearly demonstrates the advantages of modern technological developments, the development of which the Singapore authorities have financed since the 1980s (Khuong, 2013). And today, this country occupies one of the leading places in the development of ICT and has a powerful and stable economy. The authors of the study identified a number of principles of ICT implementation policies that are characteristic of developing countries.

Firstly, the introduction of ICT can make a significant contribution to the growth of economic potential. But developing such technologies is almost impossible without government support. Therefore, the interest of the state is extremely important in the implementation of ICT. The Russian financial system is dominated by bank financing, while financial markets and institutional investors own a very small part (Lozhkina, Ionova & Lozhkin, 2020).

Secondly, the process of production of ICT tools does not always contribute to economic growth due to the presence of large players in the market. Therefore, the country should determine priorities in this area, and, possibly, invest money in promoting the implementation of ICT.

Thirdly, the time factor is required. Today, many states are showing active development in this direction and are abandoning ineffective strategies that worked before. In view of this, a search for new areas of strategic development is necessary.

Similar positive examples can be seen in foreign trade relations between countries. For example, a study conducted in the United States shows the importance of ICT contributions to increasing the export of services, as well as the large role of technology in international trade (Hiranya & Lirong, 2017). In particular, there has been a significant increase in exports of transportation services from the United States, while imports demonstrate the presence of services in the field of insurance, telecommunications and tourism.

Modern China has firmly established itself on the world stage due to its strong economy. This is largely due to the rapid development of the ICT sector (Kumar, Stauvermann & Samitas, 2016). It should be noted that there is support from government agencies in the implementation of modern technologies, without which, as noted earlier, it is quite difficult to succeed in the implementation of ICT in the workplace. Scientists from China confidently argue that countries in which modern technologies are most developed have significant advantages in the field of scientific research (R&D) (Wang, 2017).

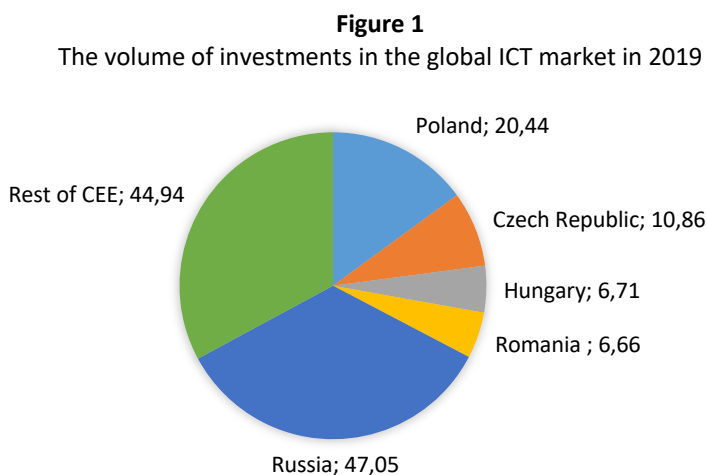
A number of authors (Pogodina, Sharipov, Idilov & Abrashkin, 2020) see opportunities to increase the competitiveness of manufacturing companies by developing competitive advantages by providing innovative and technological leadership, as well as increasing social responsibility of the business, the spread of digital technologies and the development of corporate culture.

According to analysts of the American analytical company IDC (International Data Corporation) (IDC company, 2020), the volume of the ICT market in Russia and Eastern and Central Europe has grown by 4%. In 2019, the volume of the Russian market of information and communication technologies reached \$47.05 billion, which was the largest result among all countries of Central and Eastern Europe (CEE).

The total ICT costs in Central and Eastern Europe at the end of 2019 amounted to \$136.66 billion, which is 4% more than a year ago. Thus, Russia accounted for slightly more than one third of investments.

Poland took second place after the Russian Federation with ICT costs of \$ 20.44 billion in 2019.

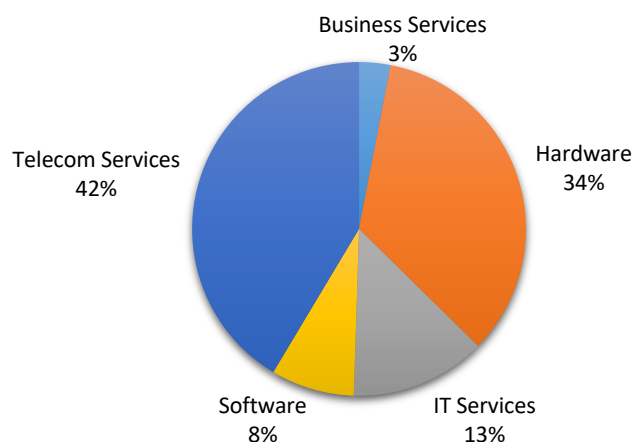
The Czech Republic closed the leading three with a result of \$ 10.86 billion. The share of spending on telecommunication services in the total volume of the market in 2019 amounted to 41% (Figure 1).



Source: according to data (IDC company, 2020)

The share of spending on telecommunications services in the total volume of the market in 2019 amounted to 41%. Sales of equipment and IT services accounted for 34% and 13%, respectively (Figure 2).

Figure 2
Cost market in the ICT industry in 2019



Source: according to data (IDC company, 2020)

As far as industries are concerned, representatives of the manufacturing, financial and telecommunications sectors invest most in ICTs - their combined share in Central and Eastern Europe is 48%.

Analysis in terms of the size of organizations shows that in 2019, large enterprises (more than 500 employees) accounted for 50% of ICT spending in the region. The medium-sized business contribution is estimated at about 23%, while small organizations and small / home offices spent another 17% and about 10% of the total.

3. Methodology

The methodological basis of the research is the theory of innovative and strategic management, the technologization of business models. As the leading methods in the article, a comparative analysis is used, which allows to study the dynamics of costs and the cost structure for infrastructure development in the ICT system of countries of Central and Eastern Europe, Russia.

Using the elements of the integrated analysis method, the factors of the influence of ICT implementation on the economic competitiveness of individual sectors of the economy and regions in Greece, Mexico, China, the USA, and also the states of Central and Eastern Europe are analyzed.

Using the cost-benefit method, an assessment of the information technology needs of enterprise management in ICT was carried out, and a calculated indicator of savings was proposed. Using the method of strategic planning SWOT - analysis revealed: internal and external factors that impede the achievement of maximum results from the use of ICT; structural and contextual factors that allow, subject to integrated use, to overcome the one-sidedness of the traditional approach to the implementation of the method in question.

Using the PEST method - analysis and the method of anonymous questioning of representatives of the business community, the content of the factor "business conditions" was clarified and its differentiation was carried out according to the degree of influence on the effectiveness of ICT implementation in the enterprise.

4. Results

4.1. Cost-benefit method

In order to assess the information technology needs of enterprise management in information and communication technologies (ICT), it is advisable to use the cost-benefit method.

At the initial stage, it is necessary to detail the costs of implementation and the use of ICT. The result of the use of ICT will be the cost savings from their use (Table 1).

Table 1
Indicators for assessing the information technology needs of enterprise management in ICT

Indicator name	Interpretation
ICT costs	
Implementation costs	Digital Costs
	Costs of the acquisition and implementation of software systems
	Program maintenance costs
	Costs of staff training related to the development and use of ICT
Utilization costs	ICT after-sales service costs
	ICT related costs
ICT implementation results	
Saving	Worker saving ratio
$\vartheta_i = \sum_1^n Y_i W_i$	Y_i – the number of employees released by the i-th investment subject
	W_i – the amount of income from one average employee

Source: compiled by the authors

As the analysis showed when choosing ICT, it is necessary to take into account that the organization cannot always completely change its business structure in order to comply with one or another standardized or typical ICT. Such changes:

- will be accompanied by large financial, material, time and other costs;
- can destroy the individuality of the organization, and with it its competitive advantages.

In addition, as a rule, the enterprise is a constantly changing structure in relation to both the range of products and relations in the internal and external environment. This leads to the need to consider the flexibility of ICTs.

4.2. SWOT analysis method

Identification of the main factors determining the possibility of ICT development was carried out using the SWOT analysis method.

To ensure the relevance of the data involved, an anonymous survey was conducted among representatives of small and medium-sized businesses within the Chamber of Commerce and Industry of one of the subjects of the Central Federal District of Russia.

The results of SWOT analysis aimed at identifying the strengths and weaknesses of enterprises in their interaction with threats and opportunities of the external environment allowed to establish internal factors ("weaknesses" of enterprises) and external factors ("threats" of the external environment) that impede the achievement of maximum results from the use of ICT (Table 2-3).

Table 2
The main internal factors hindering the achievement
of maximum results from the use of ICT

No	Factor name	% of respondents
1	Lack of relevant ICT skills among senior managers	27
2	Lack of effective interaction between the heads of commercial and IT departments	24
3	Lack of integration of various technologies in business	37
4	Price restrictions	42
5	Inability to work effectively with data and use it in business projects	18
6	Deficiencies in the planning and / or implementation of ICT projects	24
7	Resistance to ICT implementation by employees	24
8	Other	5

Source: compiled by the authors

Table 3
The main external factors hindering the achievement
of maximum results from the use of ICT

No	Factor name	% of respondents
1	ICTs require transformation to fit business needs	35
2	Lack of uniform technical standards	27
3	Weak ICT infrastructure	28
4	Lack of information regarding the ultimate cost of ownership of information products	24
5	Lack of professional qualifications in ICT	34
6	High rate of obsolescence of ICT	24
7	Shortcomings in after-sales services from ICT providers	19
8	Lack of incentives in the field of growth of innovative and investment potential of ICT	18
9	Restrictive working methods	21
10	Consequences of job automation in the public eye	14
11	Other	2

Source: compiled by the authors

In the traditional view of the implementation of the SWOT analysis method, external and internal factors affecting the organization are distinguished. But in modern realities such a division is not enough. Elements that characterize the organization's promising "opportunities", and at the same time relate to the "strengths" or "weaknesses" of the enterprise, can be identified structural and contextual factors.

Structural factors make it possible to uncover the internal characteristics of an enterprise and create the basis for measuring and comparing companies. Such factors can be divided into several groups (Brother, Klammer Calopa & Pihir, 2009).

- 1) the factor of formalization characterizes the number of approved documents at the enterprise. These include the existence of established procedures, rules, regulations, job descriptions and executive orders;
- 2) specialization - characterized by the degree of distribution of tasks between employees of the company. With a high degree of specialization, each employee is entrusted with only a small number of tasks that have a clear certainty and are included in his job description;
- 3) the hierarchy of power determines the number of levels of management in the enterprise. It is also characterized by the number of employees subordinate to one manager;
- 4) centralization is characterized by the level of decision-making in the enterprise. If decision-making is carried out only at the top level, then the organization is considered centralized, if the right to make decisions is delegated to lower-level employees - decentralized;
- 5) professionalism is defined as the degree of formal education and additional professional training of employees;
- 6) the structure and staffing of the company is characterized by the distribution of employees in accordance with the functions performed and by enterprise units.

On the other hand, there are factors that determine the contextual aspect of an economic entity. They characterize the enterprise as a whole, give a description of its main idea. These factors include:

- the size of the organization, which is characterized not only by the number of employees, but also by sales volumes and the total value of the property. As organizational technologies, the tools, methods and actions that are used to convert resources at the input to resources at the output are considered;
- the environment is a factor that is not influenced by the enterprise, but this factor itself can have a significant impact on the organization. Influence is provided by the industry, government, financial institutions, customers and suppliers;
- the mission and strategy of the organization determines the purpose of organizational existence and planned actions to achieve the goal;
- organizational culture is characterized by a basic set of core values, beliefs, judgments and norms that are shared by company employees. It has an informal character and is characterized by the history of the company, traditions, dress code and commitment of employees.

4.3. PEST analysis method

The economic overview and analytics of IDC company (IDC company, 2020), as well as studies conducted by UNCTAD (World Investment Report, 2018) show that when determining the potential of ICT in an organization, it is necessary to take into account the factor "business conditions" in the subject. Moreover, for each subject, the list of conditions will be different.

In order to determine the characteristics of the business environment for a particular region, it is advisable to use the PEST analysis method. The four-component model of PEST analysis is designed to identify the leading political, economic, social and technological factors of the external environment of enterprises related to a particular subject.

The result of the process of identifying business conditions through the PEST analysis mechanism and the result obtained during the survey of the above respondents are reflected in table 4.

Table 4
Distribution of external “business conditions” by the degree of influence
on the effectiveness of ICT implementation in the enterprise

No	Business conditions in the region	Important	Neutral	Not important
1	Self-regulatory and competitive ICT market	45	43	12
2	State incentive measures for the implementation of ICT among consumers	62	34	4
3	Investment and tax incentives for the implementation of ICT in the manufacturing sector	70	29	1
4	Effective legal regulation and consistent law enforcement practice in the distribution of digital goods and services	89	9	2
5	Effective protection of exclusive rights, intellectual property and network resources of legal entities and individuals	96	4	–

Source: compiled by the authors

The results obtained indicate that external factors of the market environment are giving priority in the development of ICT implementation processes to government incentive measures, the most important of which are elements of tax policy, legislation in the field of intellectual property protection and consistent law enforcement practice.

5. Discussion

During the development of a decision on the implementation of an ICT project, a need is identified for determining a system of performance indicators designed to assess the economic efficiency of a given project.

A similar approach since the second half of the 80s of the last century has been implemented with the differentiation of enterprises in the information sphere by the index of ICT use efficiency. The index consists of 6 components, the “weight” of which is expressed as a percentage (in the amount of 100%) (Barskov, 2016):

- budget (annual ICT costs as % of average industry revenues);
- market value (modernity of equipment as a% of its market value to company revenues);
- company profit (over the past 15 years);
- the price of staff (% of the budget or the inverse relationship between costs and efficiency);
- the cost of staff training (in % of the cost of information systems);
- the degree of user access to technology (the ratio of the number of computers and workers).

This rating is widely used in business practice.

6. Conclusions

In determining the feasibility of ICT financing in order to meet the information technology needs of enterprise management, factors such as the volatility of the internal and external environment, which necessitates the flexibility of the technologies being implemented, should be taken into account.

The process of ICT implementation in modern enterprises indicates a gradual reduction in the influence of external factors of the market environment and the growing importance of state simulation measures, among which the improvement of tax policy and legislation in the field of intellectual property protection are priorities.

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