

ASSESSMENT OF COMPANIES' DEGREE OF INFORMATISATION AND TRANSITION TO DIGITAL BUSINESS

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Abstract

The article discusses the issues of assessing the effectiveness of the use of information technologies, the vector of which is set by the Solow paradox. It is proposed to look for a solution to the paradox in the accumulated level of business informationisation, as well as in a change in the methodological approach to assessing the dynamics of labor productivity as a result of business digitalization

Keywords: *E-business, digital enterprise, business digitalization index, business informatics.*

1. Introduction

In 1987, Robert Solow formulated an idea that later became known as the “Solow paradox”: it became a paradox due to the fact that his statement is counterintuitive:

“It is not possible to demonstrate conclusively that investments in IT produce measurable results that would indicate an increase in productivity as a result of their implementation” [Platonov, 2007].

In our work, we will try to show how we can resolve this paradox by taking a closer look at the features of the use of information technologies in modern enterprises.

Today, we are at the stage of active digitalization of all spheres of social and economic life, and enterprises do not stay away from this process, because the transition to e-business, based on informatization and automation of management, ensures the economic stability and competitiveness of enterprises at the moment and in the long term. E-business-automation of business processes, improving the efficiency of management decision-making and the efficiency of the enterprise through the use of information technologies, including the I2B model: Internet technologies for Business.

The implementation of the enterprise architecture based on the I2B model involves the use of distributed information systems built on such Internet technologies as:

- information support of business processes;

- information interaction with the external environment;

- organization of internal communications.

The main attention in this concept is paid to the organization of internal and external interaction of the company in global information systems [Smirnova, 2018].

2. Analysis and Evaluation of Results

Business in the Internet space is based on the idea of a common information space that is accessible to a large number of users without reference to their geographical location. E-commerce is a part of e-business, a type of activity in which transactions between participants in a commercial transaction take place using information technologies.

Figure 1 shows a block diagram of e-business.

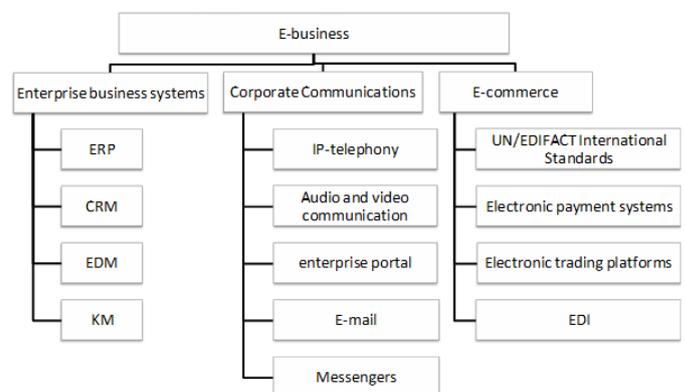


Figure 1-E-business block diagram

Business systems of an e-business enterprise as an organizational and managerial model include resource management systems (ERP), customer relationship management systems (CRM), electronic document management systems (EDM), and knowledge management systems (KM). They can be implemented on the same platform base or using different software solutions. For most enterprises, the latter option is typical, and it is rather a question of the development and evolution of business systems, rather than the implementation of a strategic solution. In this case, the company faces or will always face the question of integrating such business systems into a single set of support systems and management decision-making.

Corporate communications, which form the second set of systems, provide internal and external interaction of the enterprise with stakeholders. The development of these systems has become particularly relevant in the last few years, when the heterogeneity of the composition of stakeholders is increasing, enterprises are increasingly using non-traditional ways of organizing the work of employees, including working outside the office.

A significant role in the activity of an electronic enterprise is played by a complex of information technologies that provide e-commerce functions. This is, first of all, the use of electronic payment systems, the work of which is organized in accordance with the UN/EDIFACT standards. An integral part of modern e-commerce has become the interaction with counterparties on electronic trading platforms that provide the implementation of B2B and B2C. At the same time, the company can not abandon offline sales, adding e-commerce as part of the new digital business model.

The information space of a digital company is thus presented as a platform that includes both e-commerce applications and communication interaction systems, as well as applications of internal business systems. A promising direction

is the implementation of a service-oriented architecture and the expansion of the scope of web integration, within which software "bridges" built "between web applications and business programs of local networks of the company and its partners.

Corporate interaction technologies are reaching a new level, which, by analogy with Web 2.0, is called Enterprise 2.0. Here are expert and recommendation systems that use artificial intelligence technology.

2.1 Transition to Digital Business

One of the priority areas for the development and use of artificial intelligence technologies is "the use of artificial intelligence technologies in economic sectors that are of a general ("cross-cutting") nature and contribute to the creation of conditions for improving efficiency and forming fundamentally new areas of activity of enterprises.

Artificial intelligence technologies increase the efficiency of planning, forecasting, and management decision-making processes (including predicting equipment failures and preventive maintenance, optimizing supply planning, production processes, and financial decision-making).

They allow you to automate routine (repetitive) production operations.

Enterprises can use autonomous intelligent equipment and robotic systems, as well as intelligent logistics management systems.

Artificial intelligence increases the safety of employees when performing business processes (including forecasting risks and adverse events, reducing the level of direct human participation in processes associated with an increased risk to their life and health).

Artificial intelligence helps to increase customer loyalty and satisfaction (including sending them personalized offers and recommendations containing essential information).

With the help of artificial intelligence, they optimize the processes of recruitment and training of personnel, drawing up an optimal work schedule for employees, taking into account various factors. The creation and development of artificial intelligence systems began in the middle of the XX century. And such systems, first of all, include expert systems.

Expert systems are complex software systems that accumulate the knowledge of specialists in certain subject areas and are used to advise less qualified users. A significant advantage of such systems is the ability not only to give answers to users' questions, but also to explain on the basis of what knowledge and rules, it made such a decision.

It is advisable to use such systems if there are not enough highly qualified specialists, the task to be solved requires a large team of specialists, or a complete analysis of a complex set of conditions. Nevertheless, such systems are highly specialized. The quality of the tasks to be solved is determined by the knowledge base, which is the main component of the system. Experts from specific problem areas are involved in the development and filling of the knowledge base. Such systems have found wide application in production, industry, economy, management and other spheres of human activity. Such systems include investment portfolio formation, financial risk assessment (RAD), taxation (RUNE), etc.

The development of artificial intelligence today is aimed at "increasing customer loyalty and satisfaction", including providing customers with personalized offers and recommendations. Recommendation systems are used for this purpose.

Choosing and buying any goods or services on the Internet, we see Google or Yandex, we offer these products in for some time. Personalization of Internet marketing is an obvious trend of the last decade. McKinsey estimates that 35% of

Amazon's revenue or 75% of Netflix's revenue comes from recommended products, and that percentage is likely to grow. Recommendation systems are what you need to offer the client to make him happier" [Abrashkin, Vershinin, 2018]. In addition, the producers of goods themselves can collect statistical information: where, when, how much, to whom a certain product or service may be required.

Thus, by developing systems based on artificial intelligence, the business community forms the needs of customers in a certain type of product and at the same time receives commissions in the form of income.

2.2 Analysis and Assessment Of Companies' Degree of Business Digitalization

Quite a large number of studies have been conducted to resolve the Solow paradox. We will now turn to the review work of V. Platonov, who summarized the results of these studies and showed, among other things, that for a clear manifestation of the effect of investment in IT, it is necessary to achieve a certain critical level of accumulation of information technologies. Cross-country comparisons strongly suggest that in developed countries, the return on investment in IT is more closely related to real GDP growth. Therefore, we will then use the statistical indexes published in [Platonov, 2007] to assess the current level of information technology accumulation in Russia and other countries.

The key indicators are the following:

1. The level of use of software by commercial organizations, with a detailed description of the main functional areas of the software, which allows us to assess the level of management informatization and automation of internal business processes (Table 1);
2. Business digitalization index; including data on the use of broadband Internet and cloud technologies by organizations, providing an assessment of the level of use of information and

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communication technologies (Figures 3-5);

3. The e-retail trade index, the value and dynamics of which characterize the development of the third element of e-business as a system – e-commerce (Table 2).

Figure 2 shows the general relationship between the elements of e-business as a system and the indicators that characterize the level of development of the main subsystems at the macroeconomic level.

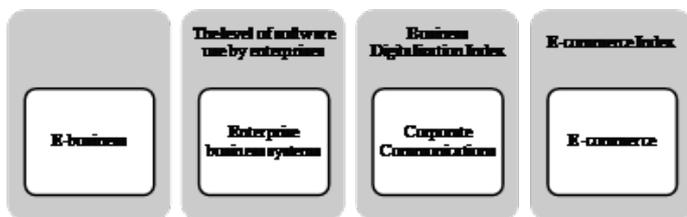


Figure 2-Key elements of e-business and indicators for assessing their status

Table 1 - Use of software tools in business sector organizations, 2018

Directions of using software tools	Specific weight in % of the total number of enterprises
Electronic document management systems	66,0
Finance	57,7
Solving organizational, managerial, and economic problems	57,3
Reference and judicial systems	54,8
Purchasing and sales management	46,2
Providing access to the database via the Internet	31,1
Management of automated production, individual technical means or technological processes	23,6
CAD	20,2
Training programs	20,0
Editorial and publishing systems	8,8
Scientific research	6,2

Source: [Abdrakhmanova, Vishnevsky, Gokhberg, 2020]

According to the Federal State Statistics Service, the total cost of software acquisition by Russian enterprises in 2018 amounted to \$ 3,270 million.

The business Digitalization index is a comprehensive indicator that reflects the level of use of broadband Internet, cloud services, RFID technologies, ERP systems, as well as the involvement of enterprises in e-commerce. Figure 3 shows a petal diagram that reflects the level of digitalization of various sectors of the national economy according to 2018 data. The highest level of digitalization is typical for the telecommunications industry, the information technology industry, as well as for wholesale and retail trade. This allowed enterprises to feel more confident in the conditions of the pandemic, which required the active use of information and telecommunications technologies.

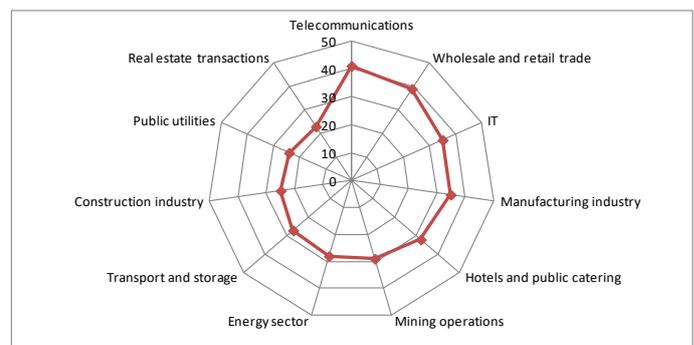


Figure 3-Business Digitalization Index, 2018

The business digitalization index is integral and consists of a set of indicators, the values of which in the dynamics for 2010-2018 are shown in Figure 4. We see that the structure of the index has changed, with the growth and development of the economy, it includes a larger number of indicators, which allows us to accurately characterize the level of digitalization of enterprises. The last adjustment to the index structure was made in 2015.

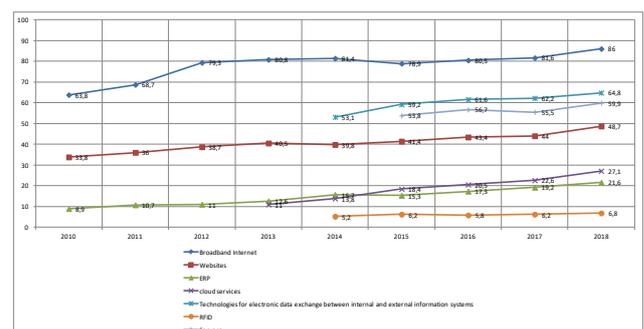


Figure 4 - Structure of the business Digitalization Index, 2010 -2018

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One of the indicators included in the digitalization index is the indicator of the use of cloud services, the structural dynamics of which is presented below (Figure 5). Forward-looking estimates allow us to conclude that cloud technologies are increasingly being used, both in the field of internal business systems (1C-Bitrix LLC, etc., is actively promoting cloud services on the Russian market) and within the framework of the e-business communication subsystem. The trend towards the use of cloud technologies can be explained by the development of the field of information technology and the deepening of specialization in it, as well as the desire to optimize business processes and costs of organizations.

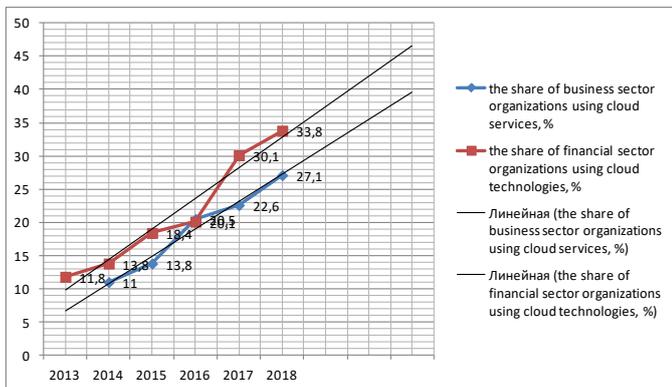


Figure 5-The share of organizations using cloud technologies, with a forecast trend line for two periods, %

To characterize the level of development of the third subsystem of e-business-e-commerce, we refer to the information on the state of e-commerce at the international level (Table 2). The value of the index in dynamics shows a tendency to steady growth despite the structural change in the index. It should also be noted that the national economy of Russia not only does not lose its place in the rating despite the change in the number of participants, but also shows an increase in the rating by 10 points over five years. This indicates significant changes in the national market, the readiness of enterprises and the population to use information technologies

Table 2-E-Commerce Index (B2C)

Russia	2014	2016	2017	2018	2019
Index value	58,0	57,6	71,0	74,2	77,9
Place in the rating	50 out of 130	47 out of 137	43 out of 144	42 out of 151	40 out of 152

Source: United Nations Conference on Trade and Development (UNCTAD)

3. Conclusion

As a result, the solution of the Solow paradox can be explained by two reasons. The first-a positive reason-lies in a somewhat erroneous methodology for assessing the impact of information technology on productivity and is associated with the presence of a time lag between changes in indicators that characterize the level of development and use of information and communication technologies (including investment in information technology), and the growth of labor productivity. The use of non-stationary time series allows us to prove this connection.

The second-negative reason – the value of the paradox mistakenly increased in importance due to the use of insufficiently accurate quantitative research methods.

Evidence of the actual impact of the use of information technologies is the assessment of the contribution of information and communication technologies to the production of the gross domestic product of various sectors of the national economy. As we can see, information and communication technologies play a significant role in trade, providing 14.3% of the added value. In the real sectors of the economy, such as mining (12.9%), transport (7.0%), construction (6.0%), agriculture (3.5%), the contribution of information technology is also quite significant.

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We predict further growth in the level of business digitalization due to the development of all subsystems and the transition of enterprises to the digital enterprise model. Information and communication technologies have become one of the key technologies of the modern economy and the driver of its development.

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