

# ECONOMIC ASPECTS OF THE DEVELOPMENT OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN UKRAINE

Экономические аспекты развития информационно-коммуникационных технологий в Украине

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**Abstract:** Information society is considered as a new stage in the human development, which is characterized by the dominance of information, information products, information technology and communications. The existence of interconnection of processes of globalization and informatization of social life are proved. The trends of information technology development and the main segments of the potential market of information technologies are determined. It is proposed to consider the use of information technologies as a complex of interrelated scientific, technological and engineering disciplines, that study the methods of efficient organization of labor engaged in the processing and preservation of information; computer techniques and methods for organization of their interaction with people and production equipment, and related social, economic and cultural issues. Virtualization has become the main trend that changes the IT infrastructure. The basic idea is to concentrate all resources of different physical systems in one large pool. As a result, there are various problems of information security, that should be taken into account. A number of business requirements that will increase demand and minimize costs to maintain the required level of service are proposed. The groups of factors that lead to an increase in economic benefits through the using of CALS-technologies are examined. The market of information infrastructure, dynamics of Ukraine's ranking on the level of development of information and communication technologies in the world are analyzed. It is determined that today in the information-telecommunication aspect Ukraine has no competitive advantages in international markets in comparison with developed countries. It is concluded about the main tendencies of the development of information and computer technologies and information and consulting services. The necessity of creating favorable conditions for the development of information and communication technologies in Ukraine is substantiated. This requires new approaches to the development of financial institutions that provide the accumulation and redistribution of financial resources for the implementation of effective structural changes. It is proposed to consider the fundamental economic strategy for the development of information and communication technologies in Ukraine not as a matter of public policy. Information and communication technologies should be transform into the subject of direct consumers', producers' and investors' interests. The state should create certain principles and conditions, diversify organizational forms and attract non-traditional sources for innovation in the field of information and communication technologies. The advantages that Ukraine can get through accelerated innovative development of information and computer technologies are determined.

**KEYWORDS:** INFORMATION SOCIETY, INFORMATION TECHNOLOGY, COMMUNICATIONS, ECONOMIC STRATEGY, VIRTUALIZATION, INFORMATION INFRASTRUCTURE

## 1. Introduction

Information society can be considered as a new stage in the human development, which is characterized by the domination of information, information products, information technologies (IT) and communications both in the field of production (Industry 4.0) and in the sphere of consumption, as well as the formation of the information industry as part of the national economy [1].

There is a close relationship between the processes of globalization and the informatization of public life. Such interdependence is obvious, because "on the one hand, information technologies cause "compression" of space, provide an opportunity for rapid interaction between different points of the globe, and on the other hand, there are global processes such as: liberalization, transnationalization, internationalization of production and capital allow the spread of the latest technology everywhere" [2].

Information technologies are the use of computer technology and communication systems for the creation, collection, transmission, preservation, processing of information in all spheres of public life [3]. Recognizing technological advances in the era of information technologies, one can identify the main directions of their development (Figure 1).

Ensuring the use of information technology is as a complex of interrelated scientific, technological and engineering disciplines, that study the methods of efficient organization of labor engaged in the processing and preservation of information; computer techniques and methods for organization of their interaction with people and production equipment, and related social, economic and cultural issues.

Globalization is directly related to the convergence that forms

today the potential market for information technologies, the main segments of which are the following elements [4]:

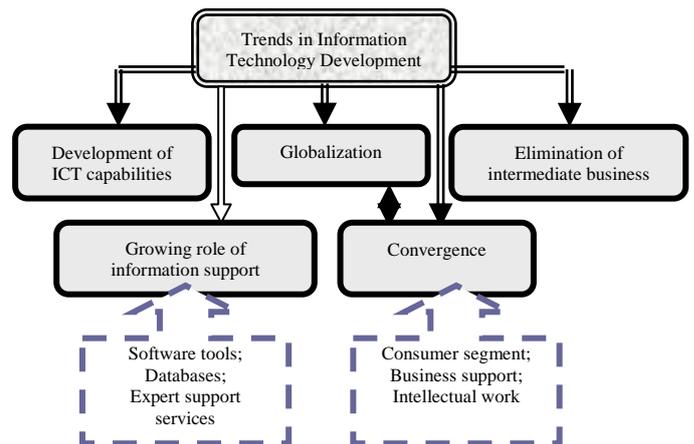


Figure 1. Trends in Information Technology Development

- consumer segment – it includes transfer of information to private individuals;
  - business support – it includes the use of products and services of information technologies in the implementation of various types of business activity;
  - intellectual work – it refers to the use and transfer of information among managers and other professionals.
- Information market through the use of information resources,

products, technologies and services and with the help of IT performs one of its main objectives – providing information in all spheres of public life.

It is well-known that IT and communications provide an opportunity for the rapid transfer of information, funds regardless of distances, and thereby ensure the creation of a global information space. Thanks to IT, it became possible for more free placement of production, without binding to developed countries.

## 2. Virtualization of IT technologies

The main trend that changes the IT infrastructure is virtualization. Virtualization technology makes information resources autonomous and independent. A global study by Penn & Berland Associates shows that 86% of IT executives plan to virtualize 75% of existing IT resources in the nearest future. According to CIO Research, 85% of companies use virtualization of servers, 37% - virtualization of storage systems, and 34% - virtualization of office systems [5].

Virtualization of storage of information separates physical storage systems from their logical representation. The basic idea is to concentrate all the resources of different physical systems in one large pool, from which it is easy to allocate storage space of different servers with different operating systems. The virtualization effect is especially noticeable where you need to replace a large number of physical servers. The cost structure of the virtualization project includes: equipment – 20-30%, software licenses – 30-40%, consulting and implementation work – 30-40% [6].

Cloud computing technology provides network access for each user to a flexible and defined set of physical or virtual resources at a certain scale, which can be independently used and regulated as needed. Referring these technologies to breakthroughs, experts and scholars predict that in the nearest future, their strong influence on markets, economics and society will grow [7].

In a cloud computing environment, all data is on many network resources that allows access to data through virtual machines. Since these data centers can be located in any part of the world beyond the reach and control of users, there are various security issues that need to be addressed.

At the same time, in terms of business, the following requirements are put forward:

- 1) the continuity of the service;
- 2) reservation;
- 3) scaling the data cluster;
- 4) automatization of technological operations.

The specified requirements allow to increase demand, and also to minimize expenses for maintenance of necessary level of service. At the same time, cloud providers have additional problems. After all, customers need a dynamic real-time scaling, which provides elasticity of replenishing or removing resources as needed. In turn, this process allows you to use a variable cost model and provide dynamic allocation of resources in real-time with correction for peak load, computing power, bandwidth and storage resources.

Virtual technology includes the CALS technology, which has emerged over the past 25 years in the United States and other developed countries. It is a paperless technology that embodies the electronic description of processes and products throughout their life cycle. It is their virtual, faultless and error-free support from development – to utilization. Products can be created by partners from different countries, language of communication – standards, means of communication – global computer networks.

The increase in the economic benefits of CALS-technologies is determined by five groups of factors [8]:

1. Intensification of the use of information resources due to the simultaneous multiple use of numerous users.
2. A record reduction in the time of release of products on the market and the conquest of the largest volume of market for a new product.
3. Decrease in the fixed costs due to the intensive involvement of fixed assets in the production cycle.

4. Significant decrease in the value of inventories and working capital.

5. Improving the quality of products at the expense of: reducing to 40% of the number of products that are lacking in the company's technical control department; reduction to 80% of the amount of processed products.

The problem of data integration and integrity is solved at all stages of the product life cycle at the same time. This radical distinction has caused the main economic advantage of CALS-technology.

Today there is a tough competition for the redistribution of world market space in the field of information and computer technology. Due to the spread of "cloud technologies", that were previously in different business segments of the market, the interests of the largest global companies are confronted and aggravated.

Internet is a universal communication space, in which very different interests and values coexist. Of course, the spread of information and communication technologies is uneven across countries and sectors of society. It should be mentioned prospect of transition to the information age depends primarily on the availability of education for all segments of the population, as well as the opportunities of operative learning and processing information [9].

## 3. Development of information infrastructure in Ukraine

The formation of the information society and infrastructure has played an important role in the innovative activity of the developed countries, as the key to the active introduction of innovation in the economy is the exchange of information. All this requires the further development of information infrastructure.

According to the Global Information Technology Report, 2016, published by World Economic Forum, Ukraine ranked 64 position among 139 countries, improving its results by 7 points in a year.

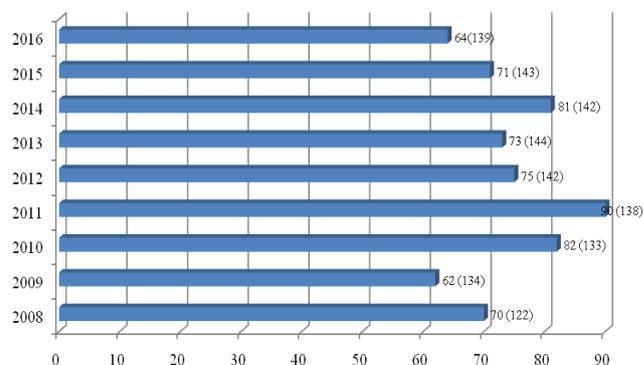


Figure 2. Rating Ukraine on the level of development of information and communication technologies [10]

International Scientific Congress "Information Society in Ukraine: The Current State of the IT Segment and Its Development Trends", held in Kyiv on October 25, 2012, formulated the main thesis for the further development of the information economy: "The development of "a new economy" was impossible without the telecommunications sector – the main instrument of management of the information flows of modern society and the basis of the economy in its modern sense".

However, the section "Information Society" appeared on the official web-site of the State Statistics Service of Ukraine ([www.ukrstat.gov.ua](http://www.ukrstat.gov.ua)) under the heading "Publications" only in the Statistical Yearbook of Ukraine for 2015 (for example, in the United States, regular IT surveys of companies on IT spending started with 2003).

According to the Table 1, it can be seen that in the field of informatization in 2016 there were 11932 enterprises and organizations, the main type of activity of which was the provision of services. That indicator was by 5.6% less than in 2010. The total number of IT specialists in Ukraine at the end of 2016 was 157.1 thousand people, which was 31.2% less than in 2010.

For 2016, the sales of services in the spheres of information and telecommunications are 117407.2 million UAH. The operating profit margin of the information and communication enterprises in 2016 increased by 1.1 percentage points compared to 2010.

**Table 1**

*Key structural indicators of enterprises about providing information and communications in Ukraine [11]*

Indicators	2012	2013	2014	2015	2016
Number of enterprises, units	13448	14885	13319	13617	11932
Number of employed workers, thsd. persons	219,5	218,1	192,7	166,4	157,1
Sales of goods and services, mln. UAH	79354,9	80410,4	84103,6	100590,4	117407,2
Computer programming consulting and related activities, mln. UAH	11654,2	14486,9	18547,3	29670,6	31550,1
Telecommunications, mln. UAH	44574,5	44088,7	44832,7	47650,8	48330,1
Earnings before tax, mln. UAH	6300,1	6817,7	-15379,9	-10166,6	4197,9
Operating profit margin, %	10,5	11,8	-1,6	0,5	8,5

Access to information for the public is becoming more and more accessible. Number of users of computer communication, including Internet, is growing at a fast pace (Table 2).

**Table 2**

*Number of Internet users in Ukraine [11]*

Indicators	2012	2013	2014	2015	2016
Internet subscribers, thsd. persons	4904	5435,3	6122,5	6000,6	14203,2
including home internet	4432	5002,4	5645,5	5557,3	13122
Computer communications services, mln. UAH	5401,6	5697,2	6190,4	7144,3	9101,8
including providing access to the Internet	4673,1	4908,5	5348,9	6130,5	6054,6
including public	2925,3	3284,7	3733,9	4125,7	6476,8

In the information and telecommunication aspect, Ukraine today has no competitive advantages in international markets compared to developed countries. This applies both to qualitative and quantitative indicators that characterize the relevant segment of the domestic market at the present stage. The greatest cumulative value for the development of the domestic economy is concentrated in the telecommunications sector of the following types of communication: mobile, satellite, as well as computer, which is responsible for incorporating the Ukrainian economy into the global Internet information space.

Table 3 illustrates the use of personal computers (PCs) and computer networks of the investigated enterprises of Ukraine (according to the results of the monitoring of the State Statistics Service of Ukraine).

The development of information and computer technologies and information and consulting services in Ukraine reflects the following trends:

- a rapid decline in the price of Internet access;
- mobile communications covering information processing and electronic document transfer services;

- information exchange moves from a centralized and hierarchical model to decentralized, horizontal, evenly distributed and democratic;

- the transition from the sale of computers to their free transfer or sale for a nominal fee with monthly payment for access to services;

- distribution of computerized interactive TVs;

- creation of clusters or zones of universal access to Internet services with the help of wireless technologies;

- development of electronic document circulation in all spheres.

**Table 3**

*Use of computers and computer networks by enterprises, Ukraine, 2016, units [12]*

Indicators	Investigated enterprises			
	total	including		
		small < 50 workers	medium-sized 50-249 workers	large > 250 workers
The number of enterprises used PCs during the year	39540	29073	8339	2128
Number of PCs at enterprises	1199001	260174	301080	637747
Number of PCs with internet access	38825	28428	8277	2110
The number of enterprises used internal computer network	24727	16387	6387	1953
The number of enterprises with Intranet network	25937	18396	5916	1625
The number of enterprises with Extranet network	3665	1898	1136	631
The number of enterprises used wireless access to the internal computer network	27907	19483	6531	1893
The number of enterprises with mobile Internet connection	9723	6414	2450	859

#### **4. Prospects for the development of information and communication technologies (ICTs) in Ukraine**

The formation of a national strategy for the development of the ICT sector in Ukraine will lay the foundations for an integrated national strategic management system aimed at ensuring achievement, and then long-term retention, a high level of global economic competitiveness of the country. Creating favorable conditions for the development of this area requires new approaches to the development of financial services institutions that provide the accumulation and redistribution of financial resources for the implementation of effective structural changes.

The basic economic strategy for the development of the sphere of ICT in Ukraine is to not first consider ICT as a subject of state policy, but to turn ICT into the direct interest of consumers, producers and investors by:

- 1) encouraging the subjects of the national economy to invest innovatively in order to increase the supply of innovative products, technologies and knowledge (investing directly in the sphere of ICT and in introducing elements of ICT into traditional branches of economy and spheres of life);

- 2) creation of conditions for the domestic enterprises to implement an offensive strategy in foreign markets, support of constructive competition in the domestic market, which will encourage enterprises to innovate;

- 3) the diversification of organizational forms of the national economy functioning, the provision of cooperation between small, medium and large enterprises in the field of development, implementation, production and sales of ICT products, development of scientific and production cooperation, industrial and financial integration, venture business, including the international level;

- 4) the transformation of "shadow" capital and the involvement of the "shadow" sector in investing, and expanding on this basis own enterprise resources for innovation activity in ICT.

## 5. Conclusion

Information technologies are not the main reason for the changes that society is experiencing at the present stage of its development. However, such changes would not have been possible in the absence of new information and communication technologies. Moreover, our planet is incorporated in the global telecommunication computer network, which is the basis for local information systems and communication processes.

Accelerated innovation development of information and computer technologies will allow Ukraine to:

- create new jobs and increase the level and quality of life of the population;
- balance interregional disproportions;
- ensure sustainable economic growth;
- enter the international markets of information products;
- integrate into international organizations;
- increase the inflow of foreign investments;
- accelerate economic reforms in Ukraine;
- build an information society.

Information nature of the present stage of civilization evolution determines the situation when no country without an effective entry into the world information space can't successfully compete in the sectors of high and medium technology not only on external but also on the domestic market. Today it is not enough to link the development of the information society only with the solution of problems transmission, access, processing and storage of information or information products. Strategic planning processes of producing information in the form of new knowledge and the mass production of information technologies, which determine the modern condition of the productive apparatus and social-economic development of the country.

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