Vol. 9 No. 1, 2023
Baltic Journal of Economic Studies
DOI: https://doi.org/10.30525/2256-0742/2023-9-1-177-183

FORMATION OF BUSINESS ECOSYSTEMS AS A BASIS FOR THE DEVELOPMENT OF THE IT INDUSTRY

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Abstract. *The purpose* of the article is to study business ecosystems from the point of view of their influence on the development of the field of IT technologies. Modern globalization processes shift the attention of scientists from the traditional fields of production to the field of information and communication services. For existing business models in the IT industry, the main issues are adapting to the new workforce and justifying which projects are better from a marketing point of view and which are better from the point of view of optimizing potential and achieving return on investment. The strategic importance of partnerships, networks, alliances and collaborations is growing, opening up new opportunities for attracting assets, mobilizing knowledge and experience, simplifying and accelerating innovation development processes. *Methodology*. Modern research methods were used to study business ecosystems in terms of their impact on the development of IT technologies: historical, dialectical method of cognition; system analysis, abstract-logical, graphical, statistical. *The subject* of research are the processes of development of the field of IT technologies through the prism of formation of modern business ecosystems. The theoretical basis of this research is the basic provisions of economic theory, national economy, state and regional administration, infrastructure theory. *Results*. Business ecosystems, which are the basis for the development of the IT sphere, have two general characteristics that distinguish them from other management models. Modularity, in which the components of the offer are developed independently, but function as a single whole. Customization, in which, unlike the open market model, the participants of the ecosystem usually adapt to it and strive for mutual compatibility. Investors see prospects and development potential in Ukrainian IT companies and therefore invest in IT, e-commerce, fintech, other innovative and export-oriented industries. *Practical implications*. The main technological trends in the development of the IT industry include: the development of cloud services; the need for various design solutions for cybersecurity; the growing need for remote work solutions; the development of intelligent solutions in the field of security and defense. The main market trends include the focus of IT platforms and technical solutions on solving specific business problems; the growing importance and share of services in the product portfolio of companies; and the high adaptability of Ukrainian IT industry players to changes and challenges in the external environment.

Key words: IT technology industry, technological trends, development of IT technologies, innovative industries, business and startup ecosystems.

JEL Classification: O10, O20, O30

1. Introduction

The field of IT technologies has become a strategic branch of the modern global economy. Accordingly, the globalization processes are shifting the focus of scientists from the traditional fields of production to the field of information and communication services. In recent decades, the world has witnessed significant changes in the way people and companies are connected and work together. Social networks allow billions of people to communicate in a variety of ways. This has enabled new forms of online commerce. Now these two trends are converging, driven by the exponential growth of the network of devices connected through the Internet of Things (Greenough, 2015).

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As with any revolutionary phenomenon, the evolution of IT technologies raises a number of questions and issues that need to be addressed. For existing business models, it is primarily a matter of adapting to the new workforce and justifying which projects are better from a marketing point of view and which are better from the point of view of optimizing potential and getting a return on investment.

New industries require new approaches to organizing business processes. The formation of business ecosystems creates new ways of solving economic problems and is a logical step in the development of a systemic approach. Ecosystem thinking captures profound transformation processes in the economy and business landscape. The strategic importance of partnerships, networks, alliances and cooperation is growing, opening up new opportunities for attracting assets, mobilizing knowledge and experience, simplifying and accelerating innovation development processes.

2. Business ecosystem: theoretical research concept

The business ecosystem is a relatively new concept in economics. It comes from biology, when in the 1930s the British botanist Arthur Tansley (Tansley, 1939) introduced the term "ecosystem" to describe a community of organisms that interact with each other and with their environment – air, water, land, and so forth. For personal and community development, organisms must not only compete and fight with each other, but also cooperate.

Much later, in 1993, James Moore (Moore, 1993) in the work "Predators and Prey: A New Ecology of Competition" applied the concepts of "business ecosystem", "entrepreneurial ecosystem", which then became widely used both in the scientific and business communities . Moore offered to consider "the company be viewed not as a member of a single industry but as part of a business ecosystem that crosses a variety of industries. In a business ecosystem, companies coevolve capabilities around a new innovation: they work cooperatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovations."

Recent studies show that in business ecosystems, firms develop mutually beneficial relationships with customers, suppliers, and competitors (Iansiti and Levien, 2004). At the same time, ecosystems evolve in different ways through self-organization, emergence and co-evolution (Peltoniemi and Vuori, 2004), and can be connected through innovation in one area (Adner, Kapoor, 2010) or multilateral cooperation. (Leten, 2013; West, Wood, 2013)

Iansiti and Levien define a business ecosystem as an interconnected group of organizations in which each member of the ecosystem ultimately shares the fate of the network as a whole, regardless of the power of the participant. In this case, an important feature of the ecosystem is the presence of a platform-services, tools, or technologies that ecosystem participants can use in their activities. (Iansiti and Levien, 2004)

In general, the emergence of the theory of business ecosystems coincided with the active use of information and communication technologies and the globalization of the economy. Against the background of the trends preceding the Fourth Industrial Revolution, the life span of business organizations has dramatically decreased. According to J. Moore's definition, business ecosystems are dynamic and co-developing communities consisting of various entities that create and receive new content in the process of both interaction and competition. He also explained that just as in biology an ecosystem is "a community of organisms interacting with each other, combined with the environment in which these organisms live and with which they also interact...", in business an ecosystem is "...an economic community based on the foundation of interacting organizations and individuals, organisms of the business world...". (Moore, 1996)

The theory of business ecosystems is structurally closely related to platforms. In fact, business ecosystems often consist of a collection of platforms on which different products and services are offered to the customer. Ecosystems can also include offline services provided to the customer, for example through an office network. This means that the business ecosystem is a broad concept and includes: marketplaces that connect a large number of producers of goods and services with potential customers. For example, in retail: Amazon, eBay, Taobao; in hospitality: Airbnb, TripAdvisor, Open Table; in transportation services: Uber, Lyft, Didi, and for freelancers: Upwork, Croogster, Fiverr.

IT systems that combine components and applications from multiple vendors on a common platform: Microsoft Windows, Apple iOS, Android, SAP NetWeaver.

Offerings that combine components from different market players: video games, e-books, smart home systems, residential solar solutions, self-driving vehicles, 3D printing, IOT solutions. Offerings that combine services from multiple vendors, such as credit card systems, smart farming or mining solutions.

Business ecosystems, which are the basis for the development of the IT sphere, have two general characteristics that distinguish them from other management models. Modularity, in which the components of the offer are developed independently, but function as a single whole. Customization, in which, unlike the open market model, the

participants of the ecosystem usually adapt to it and strive for mutual compatibility.

3. The current level of development of the IT technology industry in Ukraine

With the advent of the information age, the issue of detailed analysis of information technologies has become one of the priorities for determining the development of economic growth of the national economy and its regulatory component. The following indices are the most widely used in international practice: Information Society Index (ISI), Networked Readiness Index (NRI), Digital Divide Index (DDI), Digital Access Index (DAI), ICT Diffusion Index (ICTDI).

To justify the current level of development of IT technologies in Ukraine, the most interesting is the Networked Readiness Index (NRI) consists of four components, such as:

– environment sub-index: a) political and regulatory environment (9 indicators); b) business and innovation environment (9 indicators);
– readiness sub-index: a) infrastructure (4 indicators); b) accessibility (3 indicators); c) skills (4 indicators);
– use sub-index: a) individual use (7 indicators); b) business use (6 indicators); c) use by the government (3 indicators);
– impact of sub-indices: a) economic consequences (4 indicators); b) social consequences (4 indicators).

The calculation of the overall NRI score is based on a sequential aggregation of scores: individual scores are aggregated into bar scores, which are then aggregated into sub-index scores. The index scores are then combined to produce a country's overall NRI score. To aggregate individual indicators, scores for each indicator are normalized to a common scale of 1 to 7. Scores for survey-derived indicators are always measured on a scale of 1 to 7, so they do not require aggregation. At each level of aggregation, the normal average indicator (i.e., the arithmetic mean) is used to combine the components. (Networked Readiness Index, 2022)

Thus, according to the data in Table 1, the main players of the world market of information technologies in the conditions of globalization can be singled out the economies that make up groups of leaders from the countries of Southeast Asia (Singapore, South Korea and Japan), European countries (Finland, Sweden, Norway, the Netherlands, Switzerland, Great Britain and Luxembourg), as well as the United States of America, whose economies are characterized by a high level of population income.

This trend reflects the correlation dependence of the network readiness index on per capita income. Therefore, there is a significant correlation between the values of various international indices of the world market of information technologies, which are determined by different methods, and other indicators (Karcheva, 2017). According to the Networked Readiness Index (Table 1), Ukraine made a significant leap in the period from 2020 to 2022, rising from 64th place in 2021 to 50th place in 2022.

Accordingly, IT is one of the four priority sectors for Ukraine's export strategy. In 2022, the IT industry provided $7.34 billion in foreign exchange earnings to the Ukrainian economy (Figure 1). The volume of exports increased by $400 million in comparison with the pre-war year 2021. The amount of taxes and fees paid by the IT business to the consolidated budget of Ukraine is UAH 32.2 billion, which is UAH 4.4 billion and 16% more than in the previous year. (Finbalance, 2022)

The growth of the Ukrainian segment is not only at the expense of capturing the market share of other countries, but with the help of the development of the entire world market, which is growing at the same speed.

Table 1
Top 10 leading countries by total NRI index in 2020–2022

Networked Readiness Index (NRI)					
2020			2022		
Country	Place	Score	Country	Place	Score
Sweden	1	82,75	USA	1	80.30
Denmark	2	82,19	Singapore	2	79.35
Singapore	3	81,39	Sweden	3	78.91
Netherlands	4	81,37	Netherlands	4	78.82
Switzerland	5	80,41	Switzerland	5	78.45
Finland	6	80,16	Denmark	6	78.26
Norway	7	79,39	Finland	7	77.90
USA	8	78,91	Germany	8	76.11
Germany	9	77,48	South Korea	9	75.95
Great Britain	10	76,27	Norway	10	75.68
Ukraine	64	49,43	Ukraine	50	55,71

Source: compiled by the author based on data (Networked Readiness Index, 2020; Networked Readiness Index, 2022)

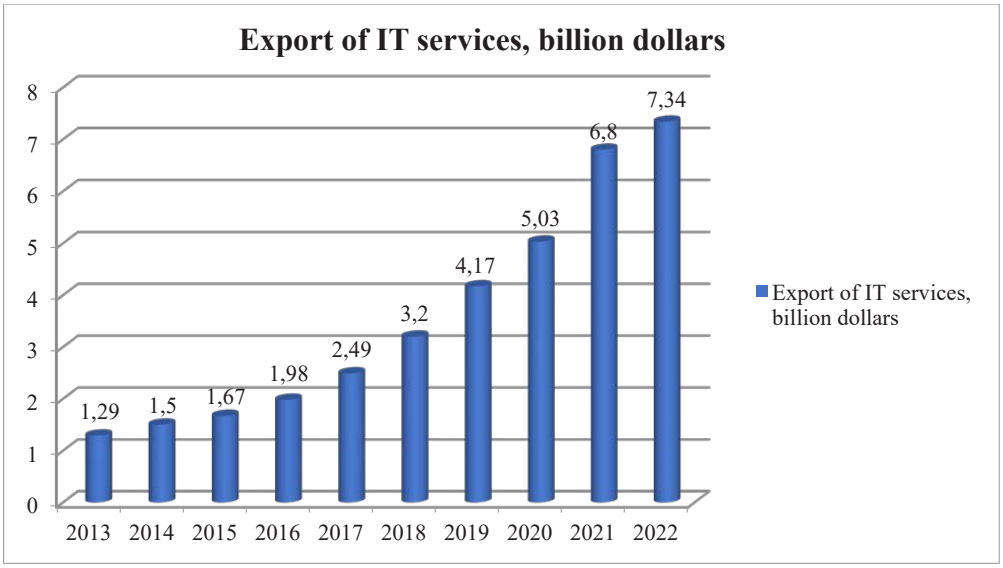

Figure 1. Dynamics of export of computer services, billion dollars

Source: (Finbalance, 2022)

Most global companies are now actively considering the ecosystem business model because of its value creation potential: growing the core business, expanding the network and portfolio, and generating revenue from new products and services (Dietz, 2020). The integrated network economy could represent a global revenue pool of $60 trillion by 2025, with its share of the total economy potentially increasing from about 1 to 2 percent today to about 30 percent by 2025. (McKinsey & Company)

4. Business ecosystem: benefits and threats to IT technologies

Today, the IT industry is an area where globalization is more visible and present than in any other industry. Therefore, it is important that scientific research and development is conducted from a global perspective, building on regional and national advantages and aligning initiatives into agreed contributions. International collaboration not only provides insight into technological developments around the world, but also allows to demonstrate core strengths in line with global perspectives and prepare for new potential markets.

The American IT market is currently the largest in the world. A large number of global brands and software companies originate from the US. To date, a large number of IT market leaders have their headquarters and research centers in the US.

Today, IT is a factor in many other key areas that underpin Europe's strategy for economic growth and prosperity. The total global market for IT and related communications is huge. The Internet is now an integral part of everyday life and the development of societies, not only as an enabling infrastructure, but also as a key factor in shaping the future. The pace of the industry is accelerating as IT and communications become an integral part of almost everything people do. As a result, demand is doubling every year as mixed traffic increases.

The main research actors are the major European IT industries and academic organizations, which jointly identify and define strategic research areas and are the main drivers of established programs and projects.

However, there is an increasing need to improve technology transfer from research to innovation and market engagement. For this reason, activities have recently been launched to address the innovation phase and to test new technologies and concepts for future market segments. The use of public-private partnerships for innovation and market engagement is promising, but needs to be more carefully designed.

When deepening the research, it is necessary to pay attention to the development of the Internet and technologies in the leading countries of the world. Figure 2. schematically shows the top 10 countries in the world with the dominant role of IT. It should be noted that they are the main players in the market of information services. Consider why the industry is emerging in these countries.

Finland has an excellent digital infrastructure, ranked the best in the world by the Global Information Technology Report (GITR). With more than 90% of the population using the Internet and a high level of innovation, Finland benefited from

Figure 2. Countries with the most developed IT sphere

Source (World Bank)

significant investments in IT in the mid-1990s in response to the financial crisis.

In Singapore, the government's support for a clear digital strategy, an ever-improving IT infrastructure, the best online services and the world's highest quality education systems have transformed this city-state into a knowledge-intensive economy with a strong IT sector (Singapore e-Government).

Sweden reflects a world-class digital infrastructure that is affordable and has a stable business environment despite high tax rates. These strengths have led to excellent use of IT by individuals, businesses and government, as well as one of the highest innovation rates in the world.

Hong Kong is well positioned for innovation and entrepreneurship, skills development and increased use of IT by both business and government. Hong Kong has a well-developed infrastructure, which has a positive economic and social impact.

South Korea is a country that has built its economic success on the IT industry. The Korean government ranks first in the world in online services. The country's focus on developing its technological potential as part of its economic development strategy has also enhanced its reputation for innovation.

These countries account for more than 80% of the world's demand for information technology products and services, with the remaining 19.56% shared by the rest of the world. This is not to say that these 10 markets are the most attractive, as issues other than size may play a more important role (World Bank).

In order to visualize the power of the Ukrainian IT ecosystem, to make it visible, measurable and effective, the Ministry of Digital Transformation of Ukraine in 2020 launched the unique 360 Tech Ecosystem Overview platform. This is an online portal for finding business information about IT companies, people, investors and, in general, the entire technological ecosystem of Ukraine. The collected information includes data on the current

development of IT companies, information on founders and executives, classification of companies by industry, investments and financing, mergers and acquisitions, company news and industry trends.

The platform was created on the initiative of the Ministry of Digital Transformation of Ukraine, the Internet Association of Ukraine and Ukrainian Bridge. As part of the project, already existing bases of USF, DOU, LIFT99, We_Challenge, Center42, UNIT.City and others were united. The Ukrainian IT industry is not the only branch of the economy that continues to develop, create new jobs, implement new projects, and attract investments during a full-scale war.

5. IT technologies in Ukraine: the way of development through dramatic events in the country

In the first months of the war, the Ukrainian IT business tried to survive, to preserve personnel and assets. During 2022, most companies have adapted to life in turbulent conditions and continue to look for new vectors of development.

Ukraine's economic growth has slowed considerably, and a rapid recovery is not expected. But it is the IT sphere that can become the basis of Ukraine's post-war development. During the war, the IT sector had the largest share in the structure of service exports – 43% (finbalance, 2022).

The IT sector remained fairly efficient, although it also had to restructure work processes and reduce the pace of development. Many had to reduce hiring of specialists, suspend current projects, and prove to new clients that it is possible to do business in Ukraine.

It is difficult to make predictions in conditions of war. The world economy has completed one of its natural cycles of development, which has been intensified by the pandemic and the war in Ukraine. The authors believe that over the next few years, businesses will be more cautious about investing in new companies and partnerships. Despite this, most of the funds will still be invested in the IT sector, so the demand for IT products will remain high.

Due to high quality, lower development costs and the possibility of remote cooperation, the Eastern European market has good prospects. That is why Ukrainian companies are already changing their development strategy, in particular, redistributing their client portfolio and entering international markets. Markets close to Ukraine are chosen for expansion, especially Poland, Romania and the Baltic States.

The redistribution of the IT market took place, but it mainly affected the labor market – companies reduced the number of open positions, while the number of actively seeking candidates increased. Over the past 5 years, investors have been willing to invest in Ukrainian IT development, the share of product companies in the Ukrainian market has grown and has equaled the number of service companies. At the same time, those who invest mainly in early-stage products are more focused on supporting portfolio projects than on finding new ones.

Nevertheless, both international and Ukrainian investors are interested in the IT and innovation market. They see prospects and development potential in Ukrainian companies and therefore invest in IT, e-commerce, fintech and other innovative and export-oriented industries (Koriako, 2022).

In general, Gartner (Gartner, 2022) identifies six key IT trends that organizations should consider in 2023:

– Secure Access Service Edge (SASE) is a single vendor product sold as an integrated service that enables digital transformation;

– Sustainable technology encompasses sustainable IT in the context of a technology-enabled business and customer sustainability;

– Platform engineering is the unification of management tools and various components of infrastructure technologies such as application resource management (ARM), application performance monitoring (APM), digital experience monitoring (DEM), and digital platform conductor (DPC) tools;

– Wireless Value Innovation (I&O) can leverage multiple wireless technologies to extend business disruption opportunities beyond connectivity;

– Industry Cloud Platforms is not one-size-fits-all. Industry clouds are an alternative to enterprises purchasing a variety of cloud offerings, as they provide a pre-integrated solution that coincides with specific vertical market needs;

– Heated Skills Competition as digital implementation continues to grow, there is a greater demand for a wide variety of skills within I&O organizations.

The full-scale war once again confirmed that the future of Ukraine lies in innovative industries. Business and startup ecosystems are actively developing in the country. The American venture fund Blue&Yellow Heritage Fund cooperates with the venture capital company ff VC. It targets Ukrainian companies and start-ups. The Innovation Development Fund, which recently came under the control of the Ministry of Digital Transformation of Ukraine, is functioning. Thanks to its work, the state has already become the largest angel investor in the country. The fund has invested more than $6 million in more than 250 startups in Ukraine and Eastern Europe.

6. Conclusions

Therefore, the main trends of modern IT technologies in Ukraine can be divided into technological and market trends. They are determined, on the one hand, by the modern development of IT technologies in the world, and, on the other hand, by the influence of specific factors of the economic situation in Ukraine and traditions of the domestic system integration market.

The main technological trends include the following:

– development of cloud services;
– the need for various design solutions for cyber security;
– growing need for remote work solutions;
– development of intellectual solutions in the field of security and defense.

The main market trends are as follows:

– orientation of IT platforms and technical solutions to solving specific business problems;
– increasing the importance and share of services in the product portfolio of companies;
– high adaptability of Ukrainian IT industry participants to changes and challenges of the external environment.

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Received on: 12th of February, 2023
Accepted on: 16th of March, 2023
Published on: 31th of March, 2023