

T. Shabelnyk,

Doctor of Economic Sciences, Professor of the Department of Economic cybernetics and System analysis, Kharkiv National University of Economics named after Semen Kuznets

ORCID ID: <https://orcid.org/0000-0001-9798-391X>

O. Liutak,

Doctor of Economic Sciences, Professor, Professor of the Department of International Economic Relations, Lutsk National Technical University

ORCID ID: <https://orcid.org/0000-0002-4293-0586>

DOI: 10.32702/2306-6814.2023.3.19

GENERAL TRENDS IN DEVELOPMENT OF GLOBAL IT MARKET

Т. В. Шабельник,

д. е. н., професор кафедри економічної кібернетики та системного аналізу, Харківський національний університет ім. Семе́на Кузне́ця

О. М. Лютак,

д. е. н., професор, професор кафедри міжнародних економічних відносин, Луцький національний технічний університет

ЗАГАЛЬНІ ТРЕНДИ РОЗВИТКУ ГЛОБАЛЬНОГО ІТ РИНКУ

У межах дослідження звернено увагу на той факт, що глобальний ІТ ринок є складною структурою, яку формують сегмент ІТ послуг, сегмент програмного забезпечення, сегмент комп'ютерної техніки, сегмент мережевого обладнання, сегмент інформаційної безпеки. Встановлено, що кожен з таких глобальних сегментів відрізняється за рівнем конкуренції навичок та за специфікою зміни реалізованого попиту клієнтів. Враховуючи таку специфічність очевидна висока динамічність розвитку сегментів глобального ІТ ринку, які зумовлена тим, що впровадження цифрових технологій продовжує прискорюватися, однак серед клієнтів реалізований попит на різні продукти ІТ ринку зростає нерівномірно. Наголошується, що частка прибутку від реалізованого попиту постійно змінюється. За таких умов відбуваються постійні зміни, з якими стикаються гравці глобального ІТ ринку. При цьому вони змінюють погляди на те, як слід замовляти, розгортати та керувати технологічними рішеннями для максимізації прибутку. Відтак, дослідження спрямоване на аналіз тенденцій розвитку глобального ІТ ринку. У межах дослідження звернено увагу та той факт, що кожен елемент структури глобального ІТ ринку містить індивідуальні життєві цикли, а відтак окремий темп зміни значень за обсягами реалізованого попиту. Очевидно, що кожен з сегментів глобального ІТ ринку характеризується певним ступенем деталізації, що здатний сформував описовий характер змін. Тенденції розвитку сегмента ІТ-послуг характеризуються сталим зростанням та досягнуті внаслідок нерівномірних внутрішніх трансформацій у всіх підсегментах з аутсорсингу; комерційних дата-центрів, IaaS, PaaS, SaaS та сервісів зберігання даних; захисту інформації; доставлення контенту. Тенденції розвитку сегмента мережевого обладнання характеризуються переходом від негативних до позитивних змін, внаслідок часткових трансформацій у найменших підсегментах з устаткування для LTE-мереж, устаткування для IP мереж, оптичних комунікаційних мереж, устаткування для бездротових мереж, Ethernet-комутаторів. Тенденції розвитку сегмента комп'ютерної тех-

ніки можна оцінити позитивно (зростання було рівномірним й в однаковій мірі охопило всі підсегменти). Сегмент програмного забезпечення характеризувався сталим зростанням місткості за обсягами реалізованого попиту (окреслене зростання отримане внаслідок позитивного зростання за підсегментами Business Intelligence та Big Data). Тенденції розвитку сегмента інформаційної безпеки позитивні та із рівномірним розвитком підсегментів з захисту інформації та мереж.

The research has drawn attention that the global IT market is a complex structure, which forms segments of IT services, software, computer equipment, communication equipment, and cybersecurity. It has been established that each global segment differs by the level of competition of skills and by the specificity of change of realized demand of clients. Given this specificity, it is obvious that the development of global IT market segments is highly dynamic, which is caused by the fact that the introduction of digital technologies continues to accelerate, but the demand for different IT market products is growing unevenly among clients. It is noted that the share of profit from realized demand is constantly changing. Under these conditions, there are constant changes with which actors of the global IT market face. At the same time, they change their views on how to order, expand, and manage technology solutions to maximize profits. Thus, the research is aimed at the analysis of tendencies of development of the global IT market. Within the framework of the research, attention was paid to the fact that each element of the structure of the global IT market contains individual life cycles, and therefore a separate rate of change of values by volume of realized demand. Each segment of the global IT market is characterized by a certain degree of detail, which can form a description of changes. The trends in the IT services segment are characterized by steady growth and achieved as a general value, which is the result of uneven internal transformations in all subsegments, including: outsourcing; commercial data centers, IaaS, PaaS, SaaS and data storage services; information protection; content delivery network. The trends in the communication equipment segment are characterized by the transition from negative to positive trends in development and achieved due to partial transformations in the smallest subsegments (equipment for LTE networks, equipment for IP networks, optical transport networks, equipment for wireless networks, and Ethernet switches). The trends of the computer equipment segment can be evaluated positively (growth was fairly uniform and in the same way covered all subsegments). The software segment is characterized by a sustainable increasing capacity by the volume of demand realized. The resulting capacity growth is due to positive growth in Business Intelligence and Big Data subsegments. The trends of the information security segment are positive with the uniform development of subsegments on information protection and network protection.

Ключові слова: сегмент ІТ послуг; сегмент програмного забезпечення; сегмент комп'ютерної техніки; сегмент мережевого обладнання; сегмент інформаційної безпеки.

Key words: IT services segment; software segment; computer equipment segment; communication equipment segment; cybersecurity segment.

PROBLEM SETTING (DESCRIPTION OF THE PROBLEM BEING ANALYZED IN GENERAL AND ITS CONNECTION WITH IMPORTANT ACADEMIC OR PRACTICAL TASKS)

At present, the global IT market is a complex structure. This is because this structure is characterized by a considerable variety of buyers who, according to the similarity of needs, desires, and opportunities, combine into segments (groups with similar characteristics). In particular:

- IT services;
- Software;

- computer equipment;
- communication equipment; cybersecurity.

Note that modern research and knowledge base TAdvice, International Data Corporation draw attention to the fact that each of the selected segments is quite specific.

Each global segment is distinguished by the level of competition of skills (which is formed taking into account the available personnel reserve in perspective directions, including experience in the field of cloud computing, automation, and advanced analytics). Each global segment is differentiated by the specific change and revenue share of the realized customer demand for priority services of

branch cloud platforms, wireless technologies, management tools, and different components of infrastructure technologies (namely, from application resource management (ARM), application performance monitoring (APM), digital experience monitoring (DEM), and digital platform management (DPC)).

Given this specificity, the high dynamics of the development of global IT market segments are obvious. This dynamic is because the introduction of digital technologies continues to accelerate, but the demand for different IT market products is growing unevenly among the clients, and the share of profit from the realized demand is constantly changing. Under these conditions, there are constant changes in the global IT market players, which change their views on how to order, expand and manage technology solutions to maximize profits. Thus, research of trends in global IT market development is actual and timely.

THE ANALYSIS OF THE LAST RESEARCH AND PUBLICATIONS IN WHICH THE SOLUTION TO THIS PROBLEM IS BEGUN

Among the research in which the solution of the problem of research tendency of development of the global IT market is started, we removed works of Dovgan L., Kozinets A. [1], Kutova N., Kozyr A. [3], Kariy O., Galkiv L., Tzapulich A. [2]. However, the research outlined does not visualize the trend as such. They only highlight their general change, regarding capacity by volume of realized demand, focusing on the improvement of theoretical-methodical and applied bases of intensification of development of IT sphere and reveal its essence. Thus, the authors, although based on the above-mentioned research, take as a basis the tendencies recommended by scientists as to the capacity of segments of the global IT market by the volume of realized demand. The authors also focus on sources that contain statistical data to change the assigned values for its segments and under segments [4]. It allows the most detailed visualization of the changes that players of the global IT market face.

THE WORDING OF THE PURPOSES OF ARTICLE (PROBLEM)

According to the above-mentioned provisions, the purpose of the article is to analyze tendencies of development of global IT market.

THE PAPER'S MAIN BODY WITH FULL REASONING OF ACADEMIC RESULTS

In general, the segment structure of the IT market is rather specific and formed according to the structure of the tree type (as it emulates a tree structure with the help of a set of connected subsegments [1—3]). This structure is a non-binding graph. Each element of the structure contains individual life cycles (which start from the moment of decision on the necessity of creation of software or information products and end at the moment of its full withdrawal from an operation), and therefore a separate rate of change of values on volumes of realized demand (or a part which is satisfied as a result of the purchase of products of global IT-market [5]) and the nature of the events that caused them.

Thus, the specificity is confirmed by the content of the XY diagram on the IT-market segments formed according to the part of products produced (y) and the value of the services purchased (x). The contents of the chart reflect the total capacity of the major subsegments of the global IT-market by the volume of demand realized as of 2021 as shown in Fig. 1.

The segment structure of the global IT market by volume of realized demand is given by us in Fig. 2.

According to the content of the chart, it's obvious that the largest volume of demand realized is the communication services segment (which accounts for 34,21% of the global IT market [4]). The IT services segment is also quite large. It accounts for 28,08% of the total IT market demand and the computer equipment segment, which covers 18,9% of the total IT market demand realized. The software segment covers 14,17% and the cybersecurity segment covers 4,6% of the total IT market demand [4]. One should pay attention to the results of the latest research on the global IT market, in which attention is drawn, and the fact that each of the above segments is

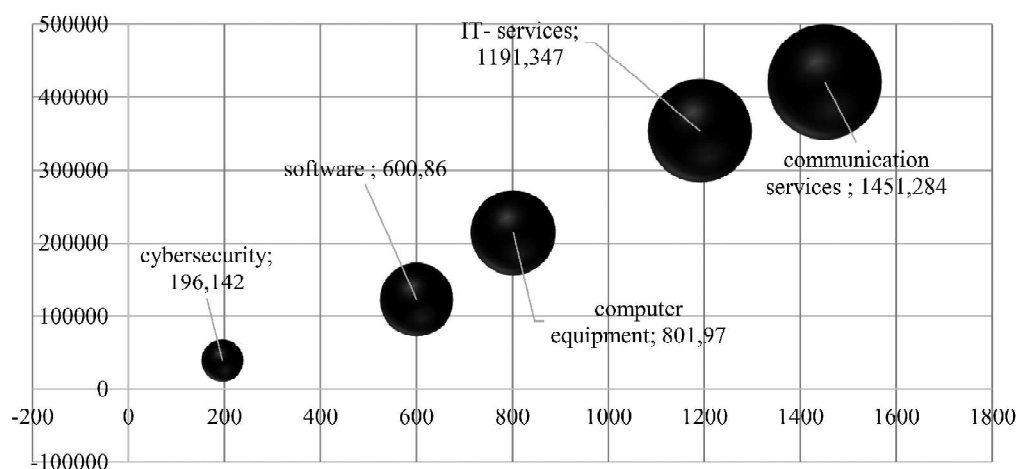


Fig. 1. Total volume of the segment of the global IT-market by volume of realized demand, 2021 (\$ billion)

Source: Gartner.

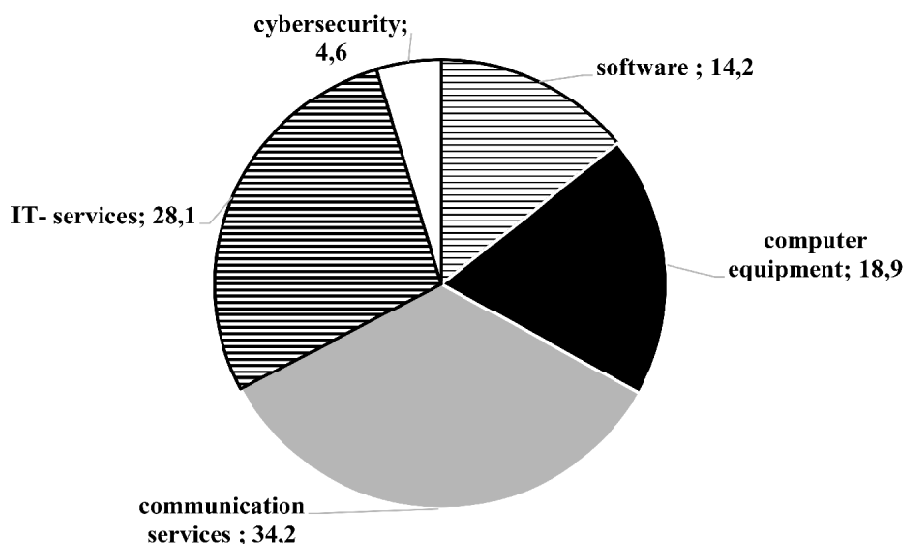


Fig. 2. The segment structure of the global IT market by volume of realized demand, 2021 (%)

Source: Gartner.

characterized by a certain degree of detail that can form a description of the nature of changes. To identify the details, we suggest focusing on the conventional segments that will allow us to better understand and visualize the trends of the global IT market. To do this, we will consider each segment of the global IT market, and its subsegments in detail.

The tendentiousness of the IT services segment is characterized by stable growth. In particular, as of 2021, the demand is estimated at \$1191,34 billion, which is 1,7% higher than the values available in 2020. The same trend is expected according to the results of 2022 (Fig. 3).

The existing in 2021 increase in demand realized is achieved as a general value, which is the result of uneven internal transformations in all subsegments, including [4]:

1) outsourcing (according to the results of 2021 reached \$360 billion, having increased by almost 13% compared to 2020);

2) commercial data centers (according to the results of 2021 accounted for \$200 billion, having increased by almost 9% compared to 2020);

3) IaaS, PaaS, SaaS, and data storage services (according to the results of 2021 accounted for \$90,89 billion, which in 41,4% more than a year earlier);

4) Information Security (according to the results of 2021 accounted for \$ 511,2 billion, increasing by 3,43% compared to 2020);

5) Content Delivery Network (according to the results of 2021 accounted for \$29,167 billion, increasing by 0,8%).

Thus, the visualization of changes in total capacity by IT services subsegments by volume of realized demand for 2020—2021 is shown in Figure 4.

The changes outlined are because the corona crisis has driven business entities in health care, finance, or headhunting to actively use cloud services, business consulting, and outsourcing of major business processes and a range of other services, which in the long term will have more than a positive impact. According to analysts' expectations, in 2022, the volume of realized demand for IT services will increase by 8,65%, while in all subsegments. This will be facilitated by the lack of technical specialists, which is a big problem in many developed countries, initiated in 2021 projects of IT system, services, or platforms implementation. In addition, AWS, Microsoft, and Google actively invest commercial data centers to increase market coverage by expanding their data entry zones [4].

The tendentiousness of the communication services segments describes the transition from negative to positive development trends. As of 2021, the segment is estimated at \$ 1451,284 billion. From 2020 to 2021, the growth was detected at 3,9% (after the decline in 2019—2020). Changes in the total capacity of the communication services segment by demand volume, 2019—2022 are

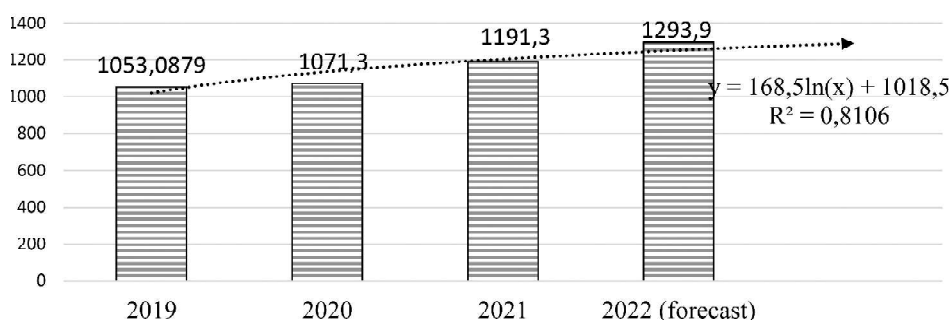


Fig. 3. Changes in the total capacity of the IT services segment by the volume of demand realized, 2019—2022 (\$billion)

Source: Gartner.

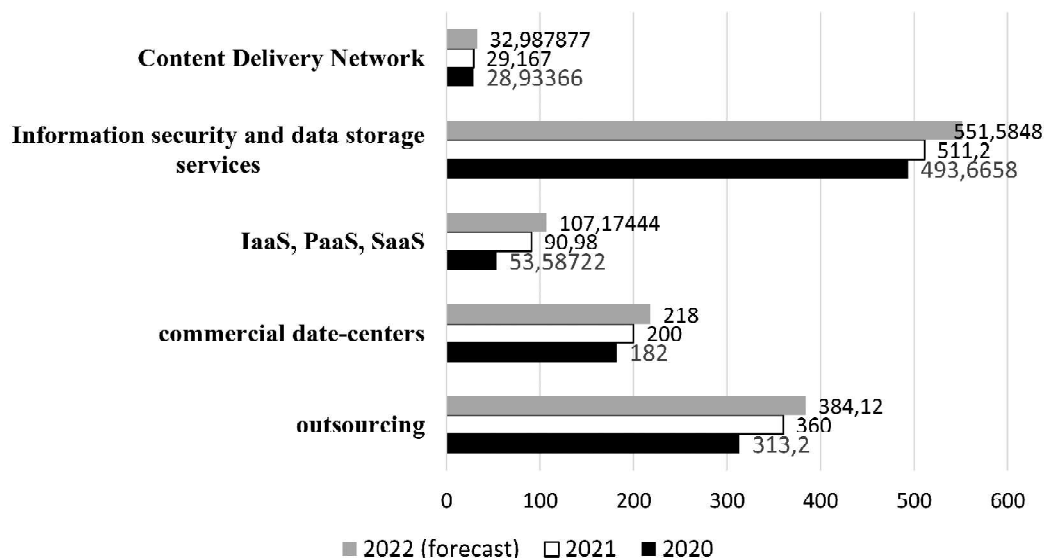


Fig. 4. Changes in total capacity by IT services subsegments by volume of realized demand for 2020–2021 (\$ billion)

Source: Gartner.

shown in Fig. 5. It turned out that according to the results of 2021 the growth of the global market of such equipment by 15%, but during the year there were problems with the supply of finished products and components to them.

The existing 2021, a modest increase in realized demand is due to partial transformations in the smallest subsegments of communication services, such as:

- LTE— networks equipment (according to the results of 2021 accounted for \$100 billion, increasing by 7% as compared with the previous year);

- IP — networks equipment (according to the results of 2021 accounted for \$329, 5 billion, increasing by 5% as compared with the previous year, due to more active sales of IP routers and scroll);

- Optical Transport Network (according to the results of 2021 accounted for \$16 billion, increasing by 1% as compared with the previous year);

- wireless network equipment (according to the results of 2021 accounted for \$172 billion, increasing by 6,5% as compared with the previous year).

In other subsegments, such as LAN Ethernet— switches of local networks the capacity in 2021 increased by 9,7% compared to 2020 and amounted to \$30,7 billion. The subsegment of routers registered increased by 6,5%,

up to \$15,9 billion [4]. The wireless hardware subsegment has reached \$17,2 billion, increasing by 6,5% as compared with the previous year. About the largest subsegment of mobile network infrastructure, the global market of distributed antenna systems for 4G networks, macro desktops, small chairs, etc. has not changed, due to the start of real development of private 5G infrastructure and expectations, for entering the market of new infrastructure devices. Thus, visualization of changes in total capacity under communication services segments by volume of realized demand, 2020—2021 is shown in Fig. 6.

The tendentiousness of the computer equipment segments is seen as positive. In 2021, the volume of realized demand increased by \$801,97 billion, since in 2020—2021 there was a transition from negative to positive development trends (after a 1,5% decline in 2019—2020, 15% growth), illustrated by the figures. 7. The specific thing is that such growth was fairly uniform. It equally covered all the subsegments of computer equipment, including high-performance computing, supercomputers, data center infrastructure, storage systems, servers, computers, thin clients, laptops and tablets, smartphones, e-books and monitors, cash services, etc.

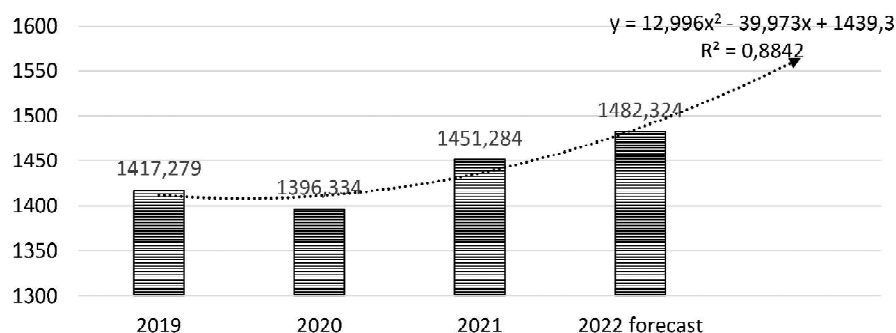


Fig. 5. Changes in the total capacity of the communication services segment by demand volume, 2019–2022 (\$billion)

Source: Gartner.

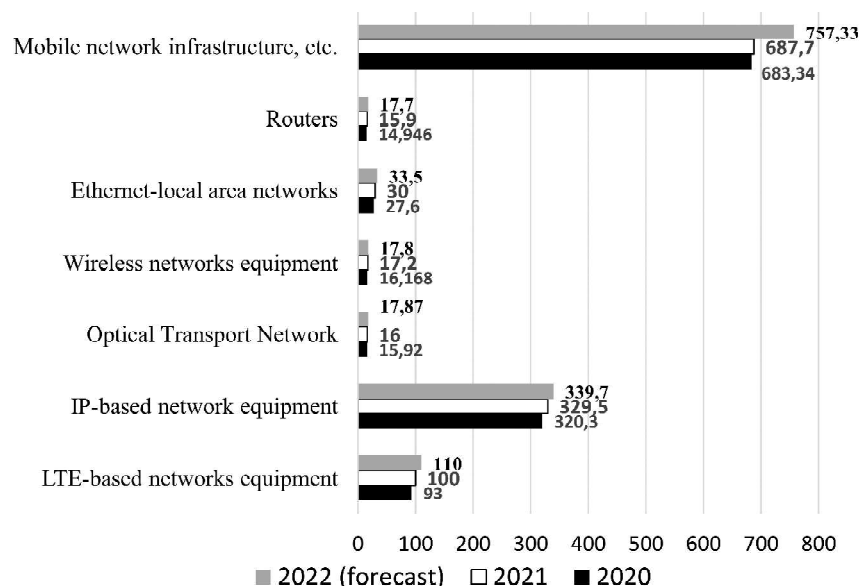


Fig. 6. Changes in aggregate capacity under communication services segments by demand volume realized, 2020–2021 (\$billion)

Source: Gartner.

The software segment is characterized by a sustainable increasing capacity in terms of demand realized. For example, in 2021 this capacity is estimated at \$600,86 billion, since in 2020—2021 it increased by 13,5%, and in 2010—2020 it increased by 10% [4]. In 2021—2022, growth is also forecast (Fig. 8).

The growth of software capacity is due to cumulative, varied changes in the subsegments, the content of which is the most detailed among the segments of the global IT market. For example, the software subsegments, which had positive growth, the main ones were Business Intelligence (which is the largest in the software segment in 2021 and estimated at \$215,7 billion, for a growth of 10.1%

compared to last year) and Big Data (which in 2021 is \$162,6 billion by the volume of realized demand, and for growth in 8,4% in compared to last year [4]). This is because data analysis is of strategic importance for the development of the company and its primary task. For other, smaller sub-segments, were characterized by a slight growth (in the interval 0,2-0,4%), which is marked by Configure, Price, and Quote to optimize sales (which is estimated at \$1,2 billion in realized demand), CRM (\$2,2 billion), ECM (\$18,7 billion), ERP (\$50,44 billion), HRM (\$22,3 billion), Linux (\$1 billion), business process analysis (\$2,1 billion), blockchain (\$4,9 billion), and operating systems for mobile platforms (\$9,5 billion) [4]. These

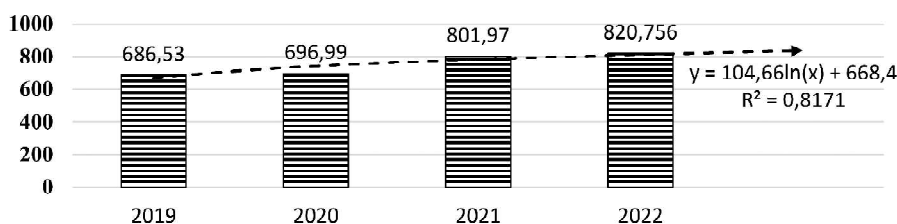


Fig. 7. Changes in the total capacity of the computer equipment segment by the volume of demand realized, 2019–2022 (\$billion)

Source: Gartner.

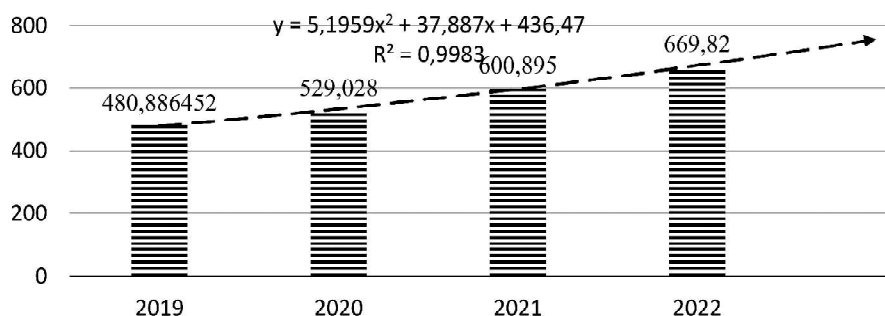


Fig. 8. Changes in the total capacity of the software segment by the volume of demand realized, 2019–2022 (\$billion)

Source: Gartner.

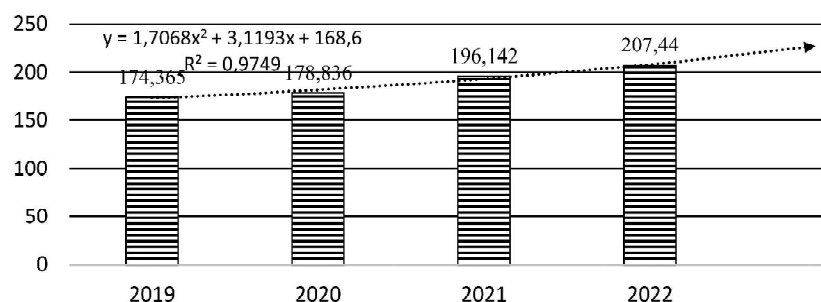


Fig. 9. Changes in total volume of software segment by volume of realized demand, 2019—2022 (\$billion)

Source: Gartner.

trends are formed by the transition from local applications to the cloud model. Companies that use this concept are damaged by the high costs associated with the use of local applications and proprietary software products. Their competitors, which implement cloud technologies and use application programming interfaces, will have a significant advantage, as cloud platforms are seen as an integral part of business operations in the digital world. In 2021, there were virtually no changes in the sub-segments: Middleware (estimated at \$28,5 billion according to the capacity of realized demand), information security services (\$4,1 billion), information security software (\$3,3 billion), medical image analysis software (\$2,96 billion), project management systems (\$1,48 billion), interior (\$3,83 billion), and so on [4]. Among the sub-segments the capacity of which decreased in 2021 due to the transition to the stage of the combustion of life cycles of most products:

- PLM solution (which is estimated at \$48,7 billion by the volume of realized demand);
- System Management Software (\$4,2 billion,)
- geometrical nuclei and horizontal portals (\$2,4 billion);
- corporate wireless email (\$1 billion);
- operating systems (\$7,7 billion);
- Software for electronic commerce, mHealth apps, DBMS, CAD, and others (\$2,0854 billion).

The tendentiousness of the smallest segment of IT market — cybersecurity is positive. In 2021, the segment capacity is estimated at \$196,142 billion. In 2020—2021, the growth in capacity by the volume of demand realized

was 9,7% [4] (which can be considered as a continuation of trends in 2019—2020, illustrated by fig. 9). In 2022, the segment capacity is expected to grow further.

At the same time, the cybersecurity subsegments are developing homogeneously, in particular, information protection (which is estimated in 2021 at \$98,142 billion and in 2022 may grow to \$105,67 billion) and network protection (which is estimated in 2021 at \$98 billion, and in 2022 may rise to \$101,77 billion), is illustrated according to fig. 10.

The current increase in cyber security demand is due to various factors, including the constant increase in the volume of harmful software. In addition, since 2021, the methods of attackers have evolved, in particular, the services of hackers become more accessible and often used as a means of competitive struggle or easy wages, which led to the formation of the Cybercrime-as-a-Service model.

CONCLUSIONS FROM THIS STUDY AND PROSPECTS FOR FURTHER EXPLORATION IN THIS AREA

Within the framework of the research, attention was paid to the fact that each element of the structure of the global IT market contains individual life cycles, and therefore a separate rate of change of values by volume of realized demand and the nature of events, which caused them. At the same time, the following conclusions can be drawn:

1. The largest volume of demand realized is the communication services segment (which accounts for

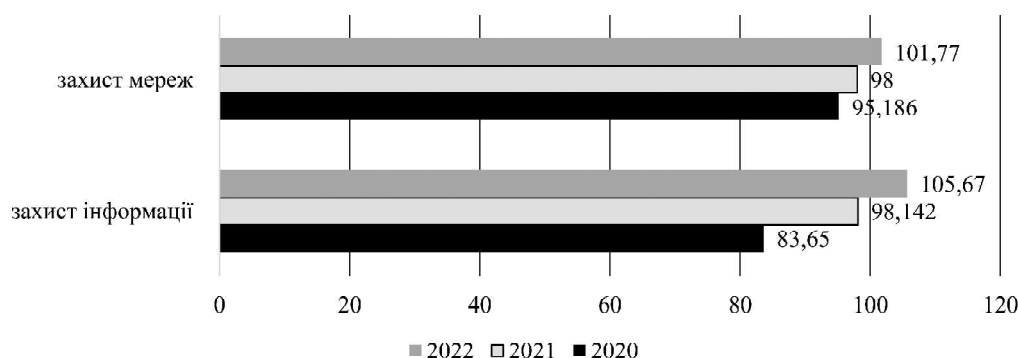


Fig. 10. Changes in the total capacity for cybersecurity by the volume of demand realized, 2020—2021 (\$billion)

Source: Gartner.

34,21% of the global IT market). The IT services segment, which accounts for 28,08% of the total IT market demand, and the computer equipment segment, which covers 18,9% of the total IT market demand, are also quite large. The software segment covers 14,17, and the cybersecurity segment covers 4,6% of the total IT market demand. Each global IT market segment is characterized by a certain degree of detail, which can form a description of changes. For details, we offer to focus on the conventional subsegments which will allow us to better reveal and visualize trends of global IT market development.

2. The tendentiousness of the IT services segment is characterized by stable growth. In particular, as of 2021, the demand is estimated at \$1191,34 billion, which is 1,7% higher than the value of 2020. A similar trend is expected according to the results of 2022. The expected increase in the volume of realized demand is achieved as a general value, which is the result of uneven internal transformations in all subsegments, including: outsourcing; commercial data centers, IaaS, PaaS, SaaS, and Data Storage Services; Information Security; Content Delivery Network.

3. The tendentiousness of the communication services segment describes the transition from negative to positive development trends. As of 2021, the segment is estimated at 1451,284 billion. From 2020 through 2021, the growth was detected at 3,9% (after the decline in 2019—2020). Initially, it was expected that by the results of 2021, the global market of such equipment will grow by 15%. However, during the year there were problems with the delivery of finished products and accessories to them. The projected increase in demand realized is achieved due to partial transformations in sub-segments: LTE network equipment, IP networks, equipment, Optical Transport Networks, wireless network equipment, and Ethernet switches. As for the largest subsegment of mobile network infrastructure, it has not changed, due to the start of private 5G infrastructure development and expectations for new infrastructure devices entering the market.

4. The tendentiousness of the computer equipment segment is seen as positive. In 2021, the volume of realized demand increased to \$801,97 billion, as in 2020—2021, since the transition from negative to positive trends of development was observed. The specific thing is that this growth was fairly uniform since all the subsegments of computer equipment were equally covered.

5. The software segment is characterized by an ever-increasing volume of realized demand. For example, in 2021, this capacity is estimated at \$600,86 billion, since in 2020—2021, it increased by 13,5%, and in 2010—2020 it increased by 10%. Growth is also expected in 2021—2022. The growth of capacity is due to positive growth in Business Intelligence (which is the largest in demand realized in 2021) and Big Data. This is because data analysis is of strategic importance in the development of the company and is its paramount task.

6. The tendentiousness of the smallest segment of the IT market — cybersecurity (estimated at \$196,142 billion in 2021) is positive. In 2020—2021, the volume of demand realized increased by 9,7% (which can be considered as a continuation of trends in 2019—2020). In 2022, the segment capacity is expected to grow further. At the same time, the cybersecurity sub-segments are developing

evenly. In particular, on information protection and network protection. The trend is caused by the constant increase in the volume of harmful software.

The prospects of further developments in this direction lie in forecasting the development of the global IT market taking into account the tendencies established by the authors.

Література:

1. Довгань Л.Є., Козинець А.В. Розвиток ІТ-сфери: проблеми та шляхи вирішення в забезпеченні конкурентоспроможності вітчизняних підприємств. Актуальні проблеми економіки та управління: електрон. версія зб. наук. пр. молодих вчених КПІ ім. І. Сікорського, 2018, № 12. Available at: <http://ape.fmm.kpi.ua/article/view/130936/126662>

2. Карий О. І., Гальків Л. І., Цапулич А. Ю. Розвиток ІТ сфери України: чинники та напрями активізації, Вісник Національного університету "Львівська політехніка". Серія "Проблеми економіки та управління". 2021. Т. 5, № 1. С. 42—55.

3. Кутова Н. Г., Козир А. А. Аналіз та перспективи розвитку української ІТ-сфери. Актуальні економіко-правові, соціальні та екологічні аспекти розвитку промисловості та суспільства: матеріали всеукр. наук.-практ. конф., м. Кривий Ріг, 2020, с. 39—41.

4. Tadviser, Global it market, 2021, URL.: <https://www.tadviser/index.php>.

5. Shukan A., Abdizhami A., Ospanova G., Abdakimova D. Crime control in the sphere of information technologies in the Republic of Turkey. Digital Investigation, 2019, 30, pp. 94—100.

References:

1. Dovgan, L.E. and Kozynets, A. V. (2018), "Development of the IT sphere: problems and solutions in ensuring the competitiveness of domestic enterprises", Aktual'ni problemy ekonomiky ta upravlinnya: elektron. versiya zb. nauk. pr. molodykh vchenykh KPI im. I. Sikors'koho, vol 12, Available at: <http://ape.fmm.kpi.ua/article/view/130936/126662> (Accessed 4 Aug 2019).

2. Kariy, O.I., Halkiv, L.I. and Tsapulich, A.Yu. (2021), "Development of the IT sphere of Ukraine: factors and directions of activation", Visnyk Natsional'noho universytetu "L'vivs'ka politehnika". Seriya "Problemy ekonomiky ta upravlinnya", vol. 1 (5), pp. 42—55.

3. Kutova, N.G. and Kozyr, A.A. (2020), "Analysis and prospects for the development of the Ukrainian IT sphere", Aktual'ni ekonomiko-pravovi, sotsial'ni ta ekolohichni aspekty rozvytku promyslovosti ta suspilstva: materialy vseukr. nauk.-prakt. Konf [Actual economic and legal, social and ecological aspects of the development of industry and society: materials of the All-Ukrainian. science and practice conf.], Kryvyi Rih, Ukraine, pp. 39—41.

4. Tadviser (2021), "Global it market", available at: <https://www.tadviser/index.php>. (Accessed 1 Aug 2022).

5. Shukan, A., Abdizhami, A., Ospanova, G. and Abdakimova, D. (2019), "Crime control in the sphere of information technologies in the Republic of Turkey", Digital Investigation, vol. 30, pp. 94—100.

Стаття надійшла до редакції 23.01.2023 р.