Raising citizens' awareness of the dangers of the Internet is done by:

1) creation of social initiatives aimed at improving the level of digital skills and digital competencies for representatives of various target groups;

2) introduction of programs aimed at raising awareness of children and adolescents, digital competencies of parents and teachers on the dangers of the child in the digital environment, the formation of intolerance culture to violate the rights, freedoms and safety of children in the digital environment.

Ensuring legal regulation on the formation of state policy in the field of digital skills and digital competencies, as well as the development of comprehensive amendments to legislation that will define digital education, digital skills and digital competencies in public life, is carried out by:

1) legal regulation of digital skills development and digital competencies issues;

2) improvement of professional standards taking into account the approved framework of professional digital competencies;

3) introduction of digital skills certification;

4) development of training programs, retraining and advanced training of specialists in accordance with the professional framework of digital competencies.

Defining the system and description of the components of digital competence (digital competence framework) is carried out by:

1) development and approval of a digital competence description, which defines key concepts, structure of digital competence by areas, knowledge, skills and practical skills of citizens, levels of digital competence and can be used to recognize, plan, develop, and improve digital competence and employees of the main professional groups in various fields of economic activity (digital competence framework);

2) introduction of requirements to the levels of possession of professional digital competencies when hiring staff, during the performance of professional

and official duties, certification, etc.;

3) development of a professional digital competencies framework for the main professional groups in the fields of economic activity and methodological recommendations for their application.

Coordination of actions at the level of executive bodies on the development of digital skills and digital competencies is ensured by involving the Intersectoral Council on Digital Development, Digital Transformations and Digitalization, established in accordance with the Cabinet of Ministers of Ukraine dated July 8, 2020 № 595 Intersectoral Council on Digital Development, Digital Transformation and Digitalization" [6].

The creation of indicators for monitoring the state of development of digital skills and digital competencies is carried out by:

1) development of research methodology on the development of digital skills and digital competencies;

2) conducting research on the level of digital literacy of various population groups, in particular school graduates and students of educational institutions, teachers, civil servants;

3) forecasting the needs of employers in certain digital skills of employees of major professional groups.

The Digital Competence Framework is a tool that allows measuring the level of digital competences of Ukrainians.

It is based on the relevant EU Citizens' Competence Framework (DigComp 2.1: The Digital Competence Framework for Citizens), which was adapted by Ukrainian experts. The framework contains 6 areas, 30 competencies and 6 levels of digital skills.

The development of the information society and the digital economy, the global processes of digital transformation that are actively taking place in many countries around the world, raise the issue of digital literacy of public servants and citizens of Ukraine on the government's agenda. This is stated in the

Government's Program of Activities and the constant statements of top officials on "the state in the smartphone", "digitalization of the economy" and "digital transformations" in government.

The main goals of digital development of Ukraine and the information society are recognized primarily by the government, as evidenced by the tasks defined in such documents as the order of the Cabinet of Ministers of Ukraine from 20.09.2017 № 649-r "On approval of the Concept of e-government in Ukraine" [7], from 08.11.2017 № 797-r "On approval of the Concept of e-democracy in Ukraine and the action plan for its implementation" [8], from 17.01.2018 № 67-r "On approval of the Concept of digital economy and society of Ukraine for 2018–2020 and approval of the action plan for its implementation" [9], Resolutions of the Cabinet of Ministers of Ukraine of 30.01.2019 № 56 "Some issues of digital development" [10], of 08.07.2020 № 595 "On the establishment of the Intersectoral Council on Digital Development, digital transformations and digitalization" [6]. In addition, in recent years, experts have developed projects "Digital Agenda of Ukraine – 2020" [11], "Ukraine 2030E – a country with a developed digital economy" [12] and the bill "On the digital agenda of Ukraine", and the analytical report [13] revealed the essence and prerequisites for the formation of digital competencies, determined the state of their development and developed proposals to public authorities.

Today, the concept of "digital literacy" has been introduced to define and assess digital knowledge, competencies and skills. Digital literacy is the ability to use digital technology, communications and networks to search, evaluate, use and create information, and perform tasks effectively in the digital environment.

In any country, it is important to know the level of readiness of the population to live in the information society, which is determined by the level of digital literacy. For example, according to the "Survey: Digital Literacy of the Population", initiated by the Ministry of Digital Transformation in December 2019, 15,1 % of the population of Ukraine did not have digital skills at all, 37,9 %

of Ukrainians aged 18–70 have digital skills below average level, and according to the European Commission, this figure is even lower (53 %). Only 25,5 % of the population estimates their level of digital skills above average, while 52,6 % of the country's population considers learning digital skills irrelevant, 47,8 % of citizens need training [14].

Among the main reasons for this situation is primarily digital inequality: 51 % of families do not have a computer, 49,4 % – a laptop, 67,6 % – a tablet, 15,7 % – a smartphone etc. Only 22,4 % of residents in Ukraine interacted with the authorities via the Internet in 2019. That is why, in order to solve these problems, the Program of Activities of the Ukrainian Government for 2019–2020 has set a goal of covering 6 million Ukrainians with a digital skills development program.

Digital literacy rate was 82,1 % in the middle of 2020 in Kazakhstan. During the two years of implementation of the state program "Digital Kazakhstan" due to the introduction of digitalization 120 thousands of new jobs were created and attracted investments worth 37,8 billion tenge ($ 0,09 billion) in the innovation ecosystem.

One of the highest levels of digitalization among OECD countries is observed in Norway, where 87 % of the population aged from 9 to 89 use the Internet during the day. At the same time, young people (16–24 years old) make up 99 %; older generation (67–89 years) – 70 %. This country has an ambitious program to teach digital literacy to the entire population, regardless of gender, age, employment, education and place of residence.

Today, many countries pay close attention to educating the population and public servants on digital skills and competencies. For example, the report "Act or Lag: Digital Future of the UK" identifies the further development of education in six main areas:

– both higher and secondary education should focus on the transfer of skills, not knowledge;

– digital literacy in schools should be taught along with the ability to count as well as literacy;

– the Internet should not be seen as a service, but as an inalienable right of every citizen, so in cities it should be available everywhere and always;

– about 6 million people in the UK have never used the Internet. Better technical support for schools will help prevent this situation in the future, for which the state is ready to allocate 63 billion pounds a year from the budget;

– gender equality in IT-related professions and awareness of women's potential for economic development. At present, stereotypes ingrained in English society prevent girls from pursuing science and programming;

– about 35 % of jobs can be automated in the next 20 years, so we need to focus on training the most skilled workers, who are unlikely to be replaced by jobs and computers soon.

Italy, Spain, Portugal, Ireland, the United Kingdom and other countries adhere to the DIGCOMP Framework minimum literacy program, which covers the following areas of digital competence:

– work with information (data): the ability to identify, locate, classify, receive, store, organize and analyze digital information in terms of its relevance and purpose;

– communication: the ability to communicate in a digital environment, share resources through online tools, interact with communities and cross-cultural awareness networks;

– content creation: the ability to create and edit new content (from word processing to images and videos);

– security: ability to use personal data protection and digital identification;

– problem solving: the ability to identify digital needs and resources, make informed decisions and choose appropriate tools to implement conceptual tasks using digital tools.

To increase digital literacy, governments in many countries are actively

creating and promoting specialized educational resources. In 2020 to eliminate digital illiteracy in Ukraine, the Ministry of Figures launched the national online digital literacy platform "Diia: Digital Education" (osvita.diia.gov.ua). Courses for it were developed by the online education studio EdEra (www.ed-era.com) with the support of Google, Microsoft, CISCO, Global Teacher Prize, DTEK Academy, UNDP, and the educational videos themselves are made in the form of educational and entertaining series. The project "Diia: Digital Education" is supported by the Swiss-Ukrainian EGAP program, funded by the Swiss Agency for Development and Cooperation and implemented by the Eastern Europe Foundation. Currently, the resource osvita.diia.gov.ua contains almost a hundred educational videos for more than 10 categories of users (civil servants, teachers, students, parents, novice businessmen, active citizens, etc.).

The movement towards digital education of the population in the regions of Ukraine is beginning. For example, in summer 2020, deputies of the Kharkiv City Council voted for the adoption of the "Concept for the development of digital literacy of Kharkiv residents". During 2019, the Kirovohrad region implemented an educational project "Electronic Citizen of Kirovohrad Region" (center.kr-admin.gov.ua), aimed at teaching older people computer skills and using available online services in everyday life.

To determine the level of digital education on the portal osvita.diia.gov.ua in November 2020, the use of the national tool for digital literacy testing "Digital" was launched. During the first month of its operation, more than 34,000 Ukrainians passed their level of digital literacy.

It is important to note that today in the field of public administration in Ukraine there is an understanding of the need to develop such competencies as "digital literacy", as evidenced by the introduction of CDTO positions in central executive bodies and regional state administrations [15] skills for "digital literacy" [16].

Questions for self-control:

1. What is digital competence?
2. Name the main problems in the development of digital competencies.
3. Describe the Concept of Digital Competence Development and action plan for its implementation.
4. Outline the purpose of the Concept of Digital Competence Development and its objectives.
5. How is the coordination of actions at the level of executive bodies on the development of digital skills and digital competencies ensured?
6. What is the framework of digital competencies?
7. How to determine the system and description of the components of digital competence (digital competence framework)?
8. How are indicators created to monitor the development of digital skills and digital competencies?
9. Give examples of the development of digital skills and digital competencies in Ukraine.

11.2. The influence of modern Fintech trends in the training of specialists in the economic field

The development of the financial market has undergone significant changes recently. On the one hand, the requirements for risk management have been strengthened. Thus, the standards KYC (Know Your Customer, which regulates the procedure of customer identification) and AML (Anti Money Laundering, which should help combat money laundering) were implemented. On the other hand, there has been a significant development of digital technologies and innovations. Thus, the Internet and social networks began to develop rapidly, the share of smartphones and tablets in the market of digital gadgets began to expand

significantly, which required an increase in specialized mobile software [17]. All this required a significant number of proposals for digital products and services in the financial sector, which gave impetus to the development of Fintech.

Financial technologies (Fintech) are technologies aimed at improving and automating the provision of financial services. Their main task is to make it easier for large companies, business representatives and end users to work with their own finances. This is done using specialized software, both on computers and on various digital gadgets.

The term "Fintech" first appeared at the beginning of the XXI century, but then Fintech was mainly related to technologies used by large financial institutions. However, it soon became clear that their scope could be extended to ordinary consumers of various financial services. At present, financial technologies have penetrated most segments and sectors of the financial sector, as well as in education, retail, investment and a number of other areas of human activity [18]. With the advent of new technologies, the focus of banks on internal processes due to the crisis of 2008 and the desire of users to experiment with digital services have led to the emergence and growth of new Fintech companies. Such companies use the latest developments in the field of mobile payments, online lending, digital instant transfers and other advanced technologies. Organizations built on such models are at the forefront of the latest technology and usually offer their services mainly through the Internet.

The network model of this business allows to:

– obtain new sources of financing for small and medium-sized businesses and significantly reduce costs;

– increase the availability of financial products for all categories of the population;

– to meet the needs of the client with maximum completeness in the shortest possible time.

Savings make it possible to offer customers financial products on very

favorable terms, in particular through special software that takes into account the individual preferences of the user. So, Fintech companies currently offer the following services:

– payment decisions and merchant services;

– Internet banking and P2P lending;

– international money transfers;

– investment management and private banking;

– processing and organization of large amounts of information – Big Data.

Companies engaged in this industry can be divided into startups that provide technical solutions for existing financial companies and that work directly with consumers of financial services. The categories of Fintech companies are divided into areas of activity: Personal Finance Management, Blockchain, Payments, Marketplaces (Lending), Investment Platforms, Collective Funding (Crowdfunding), Security, B2B Fintech, Money Transfers, Big Data Analysis, RegTech, InsureTech, Artificial Intelligence, Neobanks (Challenger Banks), Cryptocurrencies.

Banks have traditionally dictated rules and forced consumers to follow them, while new Fintech companies are willing and able to recognize the needs of consumers of financial services and try to meet them. Without constant changes in line with the latest Fintech trends, existing financial institutions are doomed to lose to new financial market players. Financial services in cyberspace are becoming their key tool. The division into traditional channels (bank branches, call centers, ATMs and terminals, shopping malls) and the Internet is dying out, as it is important to serve the customer where he will spend the most time [19, p. 124]. Declining margins in the banking business are forcing banks to cut costs and close branches. Remote channels remain the only tools to maintain the quality of service. The cheapest is online access to banking services and mobile banking. The bank is becoming not only a financial institution, but also a platform for cooperation.

Service organizations are the future. Banks will change under the influence of customers, and financially literate customers will force banks to change. If financial institutions have historically serviced money, now the industry that will be the first to learn how to serve customers better than others will benefit. Fintech, by changing the expectations and habits of financial services consumers, causes growth in their democratization and the spread of financial reach [20, p. 585]. There is growing competition for a secured client and a reliable borrower – and these are the most demanding customers who value their time, willing to pay for speed and convenience. To attract and retain such customers, you need to be able to offer quality and technological service. And this applies primarily to remote service channels.

The Fintech industry is changing not only the financial sector, but all related sectors (that is, virtually all), changing business models [21]. Thus, innovations in lending and payments, which are expressed in the emergence of alternative lending models, the use of unconventional data sources and powerful data analytics in risk assessment, accelerating credit processes with customer focus and reducing operating costs, open a new perspective on business startup services (for example, for the retail sector) and access to the international level.

Accordingly, the labor market is in demand for workers with fundamentally new knowledge and skills needed for Fintech. Namely, the profession of Fintech-specialist appears, bordering on the junction of both finance and technology [22, p. 274]. The future lies in such hybrid professions.

The profession of Fintech specialist can sometimes be confused with the profession of IT specialist, limiting its breadth to specific technologies (such as big data or blockchain), analysts and developers. In fact, financial technology companies need not only analysts and developers, but also IT architects, project managers, product scientists, information security experts, economists and lawyers, but with different functionalities.

They must be able to design, implement, maintain and promote projects, both

in the field of Fintech and in the global digital environment. They need to have unique problem-solving skills, as well as understand how they can effectively implement digital change in their personal work and in the business of their employer as a whole [23]. Thus, a Fintech specialist combines the knowledge and skills of a Fintech programmer, digital marketer and product manager with experience in an Internet project or Fintech startup.

Fintech specialist must have a number of skills:

1. Multitasking. It is an opportunity to perform several processes simultaneously, smoothly switching from one task to another. Initially, the term was used exclusively in the programming environment, but gradually it migrated to the Fintech industry. Multitasking is a combination of analytical thinking, a solid systems approach and a high level of organization. Even if you do not consider these properties to be your innate traits, you can develop them through practice.

2. Communication. Continuous improvement and release of new products are the main features of financial business based on technology. Client managers in this field must be aware of all the trends, innovations and competitive solutions in the market, constantly learning new things.

This is not just about the technological skills needed for financial technology. In the past, personal VIP account managers in large banks were more like professional lobbyists and networkers. They have expanded their customer base with recommendations and connections, never missing a major industry exhibition or conference. The same skills have always been and will always be in demand among Fintech customer managers.

Today, conferences are not only a way to establish useful contacts, but also function as expert training. The customer service professional must be able to use all communication channels that are convenient for the customer, and constantly explore these channels for new opportunities. For example, in the United States and Western Europe, in addition to e-mail, the main channel of interaction in the

B2B sector has become social networks (in particular, LinkedIn). However, e-mail and personal communication remain the main ways for businesses to communicate with financial service providers [19, p. 125]. This means that a good customer service specialist at Fintech must not only be able to speak nicely and show empathy, but also to conduct business correspondence competently.

3. Business Management. The ultimate goal of every company is to work like a well-oiled machine, and the person responsible for this is called the business manager. They provide their employees with all the resources needed for daily work. So when a company has a good manager, there is someone to maintain the car. Business management includes a set of activities related to the planning, organization and management of business facilities. In order for any Fintech company to grow, it is necessary to properly coordinate the set of operations and their coordination, which is the task of business management for the development of any Fintech company.

4. Extended Expertise. All modern providers of financial services, payment solutions, insurance and capital management have grown from small startups, where quality customer service was and remains both part of the business model and competitive advantage. The payment platform is difficult to set up and maintain, and customers often need advice during this process. The manager should not only respond to any request as clearly and quickly as possible, but also know your product, understand the peculiarities of national legislation, be able to explain the acquisition of technology, algorithms to combat Internet fraud and more. A good specialist with clients is attentive to the little things and can easily talk about complex things. Fintech's customer manager must be personal for each customer. They know how to hear and listen, immediately delve into the client's problem, consider it from different angles and offer the best solution.

5. Programming Skills. Today, in the digital age, programming is becoming a full-fledged international language of a new format. Perhaps in the future it will be as natural for an educated person as the ability to write, read, and count.

Obviously, practical knowledge of information systems and technologies is a basic skill that is indispensable. Technical expertise allows you to objectively check the achievability of the desired project results and compare these results with organizational capabilities and constraints [18].

A specialist at a Fintech-company requires the ability to work in a specialized team development environment, as well as to understand the principles of distributed systems architecture, mathematical models and processes used for risk analysis. Also, such an employee must know the principles of automation and monitoring, technology and specifications, testing methods. The financial technology manager should be able to assess technical risks and competently answer questions from developers, programmers, analysts and engineers. All this is impossible without sufficient knowledge and experience in the IT field.

6. Data Analysis. The analyst's work involves the use of SQL, Python and other programming languages, creating dashboards and automating processes. But these are just tools to achieve two goals: make decisions more objectively on the basis of facts and evidence (as opposed to thought, intuition, and experience); look for growth points for both the product and the business. The analyst focuses on studying data, structuring complex financial systems, and understanding the processes that benefit business. Fintech-analytics product consists of answers to both asked and unanswered questions, creation of thinking models and frameworks, as well as recommendations based on them, which lead to increased business efficiency [18]. The best way to achieve this in most cases is to work with data, but this is not always the case.

Analytics help make decisions that lead to actions in the product and business. In some cases, you can make decisions without analyzing the data, simply formalizing all possible situations and solutions, and then rejecting most of the options, relying on what the team already knows. This is not about industrial programming. As a data analyst, you must be able to read documentation, quickly understand and use data manipulation tools, and automate your routine.

7. Knowledge of AI and ML. The stage of training artificial intelligence to solve artificial problems, such as chess gambits or analyze unnatural algorithms and events is almost over. A new stage in the introduction of neural networks in real aspects of human activity has begun, from modeling trends in the exchange and management of urban traffic, to genome analysis and drug development.

AI developers are actively working on the introduction of neural networks in the financial sector. AI will soon be a true helper for any trader, and in the future, when neural network training becomes a norm, AI will be able to trade for people just as users would trade, only more efficiently and 24 hours a day.

8. Cybersecurity and Blockchain. Nowadays, no industry can do without a proper knowledge of cybersecurity, especially Fintech. Both startups and large companies need to be confident in the security of their data. Information systems are expanding day by day in the financial sector, and this leads to the need for specialists with an understanding of cybersecurity basics. This has become especially popular with the rise of cybercrime. Hacking and virus launches have become commonplace in today's computer infrastructure.

The use of blockchains makes it possible to execute contracts and agreements without the involvement of lawyers and bureaucratic red tape, making investments secure through smart contracts for effective risk management. In addition, this technology is very convenient to confirm copyright, and indeed, blockchain technology can be used in a variety of areas, from trade to elections [17]. Thanks to blockchain technology, you can exclude the participation of third parties in financial transactions. You can also save and transfer funds without the participation of the bank, because, as we have said, blockchain systems have successfully implemented the ability to confirm identity, register transactions and perform contracts. Decentralized platforms can also be used to inventory and manage assets, manage transport and logistics processes, trade, track the origin of goods and materials, optimize supplier identification, sign procurement contracts, and audit and track transactions. Thus, this

technology is used not only in the market of banking and financial services, but also in many other market sectors, making customers life easier and more comfortable. Therefore, no less important skill for a Fintech specialist is understanding the basics of blockchain.

9. Understanding of Finances. A financial technology manager needs to know how to calculate and analyze various financial transactions, tax, audit and accounting fundamentals, and capital management features to maximize profits. Also, the work can not be done without the ability to form a long-term perspective of the business as a whole, assess project prospects and competitiveness of various products and control the financial and economic operations of the company. The competence of such a specialist is also to analyze the advertising market. A financial technology specialist uses accounting and economic data to assess the financial condition of an organization and manage its financial flows. They are invited to understand the intricacies of both specialties.

10. Mathematics, Statistics and Probability. To work in the Fintech industry, you will also need knowledge of mathematics, statistics and probability theory. In fact, this knowledge is a system of necessary calculations of the profitability of financial, investment and trade transactions over time, taking into account inflation, exchange rates, interest and other legal and factual conditions of contracts. Financial mathematicians study payment schemes and interest rules, but this is not their main function. They also provide an objective answer to the legitimate question: “Which of the possible financial transactions is more profitable?” Few economic disciplines can boast of such specificity.

This is easy if the loan scheme or other operation is simple. But how to measure profitability in more complex cases, when the flow of costs and revenues is irregular? Not every economist will answer this question. Financial mathematics provides tools for analyzing and comparing the profitability of various operations. It can not only to show how profitability is calculated, but also to make practical proposals and analyze the economic meaning of the results.

Understanding all these processes will be a huge plus for a financial technology specialist. Thus, the profession of Fintech specialist, or in other words, financial technology manager requires knowledge and skills in various fields, such as accounting, finance, management, programming, data analysis, mathematics and more [24]. This knowledge will help the specialist to competently bring the product to market, maintain the efficiency of the team, as well as build trusting relationships with customers and partners.

Questions for self-control:

1. What is Fintech?
2. What services do Fintech companies offer?
3. What is the difference between the profession of Fintech-specialist from IT-specialist?
4. What skills should a Fintech specialist have?
5. How does the multitasking skill affect the Fintech specialist?
6. How do business management skills affect the work of a Fintech specialist?
7. What level of programming skills should a Fintech specialist have?
8. How did the development of artificial intelligence affect the development of Fintech technologies?
9. What is cybersecurity and what is its significance for Fintech?
10. At the junction of which sciences is formed Fintech?

11.3. The study of Big Data technologies as a basis for training in the digital economy

The digitalization of the economy is a challenge of the present era. It determines the digital transformation of both economy and society. It saves time,

increases productivity through the process of automation, optimizes and improves communication, creates competitive advantages and access to a new level of service. The development of digitalization occurs due to the ability to collect, use and analyze huge amounts of digital data. Information is generated very quickly, so its processing and analysis play an important role, therefore, big data technologies are used to solve these problems [25].

The digital transformation of the economy necessitates the training of digital specialists: data scientists, data engineers, machine learning engineers, Internet marketers, web analysts, etc. [26, p. 40]. Professionals who have an understanding of the modern paradigm of data organization and management are able to find patterns in large data sets and conduct experiments to find useful information for business. Such specialists must "be fluent" in the language of business, know their field of application, understand its main problems and be able to find and make non-standard management decisions based on data.

The digital economy is transforming traditional economic activities, forming fundamentally new business models and constantly improving, introducing cloud technologies, artificial intelligence, new virtual reality, accumulates huge amounts of data (Big Data), which while reaching critical mass become the capital of digital economy [27].

A characteristic feature of the digitalization of the economy is the emergence of modern Big Data technologies. The term Big Data refers to a group of technologies and methods used to analyze and process a huge amount of data, both structured and unstructured, to obtain qualitatively new knowledge [28]. In summary, this is information that cannot be processed in classical ways due to its huge volume.

Big Data works on the principle: the more information we have, the more accurate forecast we can make. Also, the ability to compare certain data and the interconnections between them allows to find regularities that were hidden before. All this provides a deep understanding of the problems and, ultimately, allows you

to find solutions or opportunities to manage the right processes.

Data Science is the science of data analysis. It is necessary to analyze the data in order to extract specific and useful information from a huge array of information: insights into consumer behavior, market trends, based on which you can make quality forecasts for the development of some sphere or separate industry. Data Science is related to Machine Learning, Cognitive Science, while Big Data is a division of Data Science.

Most often, processing large amounts of data involves building models and running simulations, during which key settings are constantly changing, while the system constantly monitors how these changes affect the possible outcome. This all happens automatically until a key point is found that will help solve the problem.

The history of Big Data begins much earlier. According to one of the authors of Forbes, the starting point can be considered 1944, when the American librarian Fremont Rider published "The Scholar and the Future of the Research Library". There he noted that the funds of university libraries in America are doubling every 16 years and by 2040 the Yale University Library will contain about 200 million books, which will require storage of almost 10 km of shelves. According to another view, the realization of the problem of too much data came earlier, back in 1880 again in America, when the processing of information and presentation of census data in the table took eight years. At the same time, according to forecasts, the processing of census data from 1890 would take even more time and the results would not be ready even for a new census. Then the problem was solved by a tab machine, invented by Herman Hollerith, founder of IBM, in 1881. The term Big Data was first introduced (according to the electronic library of the Association for Computing Machinery) in 1997 by Michael Cox and David Ellsworth at the Eighth IEEE Conference on visualization. They called the problem of big data the lack of capacity of main memory, local and remote media to perform virtualization. And in 1998, SGI's head of research John Mashey used

the term Big Data in its current form at the USENIX conference [29].

And although the problem of storing large amounts of data has long been recognized and intensified since the advent of the Internet, the turning point was 2003, when more information was created than in all previous times. Around the same time, Google File System published a publication on MapReduce computing concepts, which formed the basis of Hadoop. Over this Doug Cutting worked on the Nutch project for several years, and in 2006 Cutting joined Yahoo and Hadoop became a separate full-fledged solution [30–31].

Big Data is sets of information (both structured and unstructured) so huge that traditional methods and approaches (mostly based on business intelligence solutions and database management systems) cannot be applied to them [32, p. 893]. An alternative definition calls Big Data a phenomenal acceleration of data accumulation and complication. It is also important to note that this term can often be used in different contexts to refer to both large amounts of data and a set of tools and methods.

The report by the McKinsey Global Institute in May, 2011 stated: “Big data is data sets that are beyond the capabilities of conventional data collection, storage, management and analysis software”. From these definitions, an object that is considered “big data” changes with the development of technology. Data that was once “big” or data that is considered “big” today will be different from “big data” tomorrow. These definitions mean that the essence of “big data” may differ depending on the industry or even the organization, if there is a significant difference in the capabilities of tools and technologies.

The concept of “big” applies not only to the amount of data. Although, first of all, the presence of a big amount of data is implied, at the same time it implies the presence of some other features. “Big Data” is characterized by increased speed of transmission, complexity and diversity of sources compared to data sources of the past. Such factors make it difficult to work with “Big Data”, because we have to deal not just with a big amount of data, but with the fact that

they come very quickly, in complex forms and from different sources.

Big data has been in the spotlight since its inception in business. Many organizations understand the importance of Big Data and use it for their business. Entering big data helps businesses identify new business opportunities and increase their efficiency. This, in turn, will help increase their profits by winning many customers. In today's world, the concept of big data is considered more important for the following reasons:

1. **Costs reduction** – big data technologies are more economical. And it's the best tool for storing huge data at a lower cost. It also helps identify more effective ways to do business.

2. **Fast decision-making** – with in-memory analytics and the ability to analyze new data sources, Big Data helps businesses analyze data and information faster than ever before. Business can make smart decisions based on learning through analysis.

3. **New products and functions** – with the right analytics, big data concepts know customer needs and satisfaction. That's why they always deliver what customers want. Some companies are also creating new products using big data analytics to satisfy their customers.

The first companies to realize the hidden value of large amounts of information were Google, Amazon, Yahoo, Facebook, which developed tools for collecting, analyzing and storing large amounts of data. The development of cloud solutions has led to an increase in the number of data centers and a reduction in the cost of their services, which in turn has significantly reduced companies' storage costs [33, p. 64].

The active digitalization of documents, books and films has contributed to the development of the big data concept. Another giant data source is IoT (Internet of Things) devices and sensors. IoT and machine learning are key drivers for the growth of the global Big Data market, which Statista/Wikibon estimates will reach $ 103 billion by 2027 (Fig. 11.1) [34].

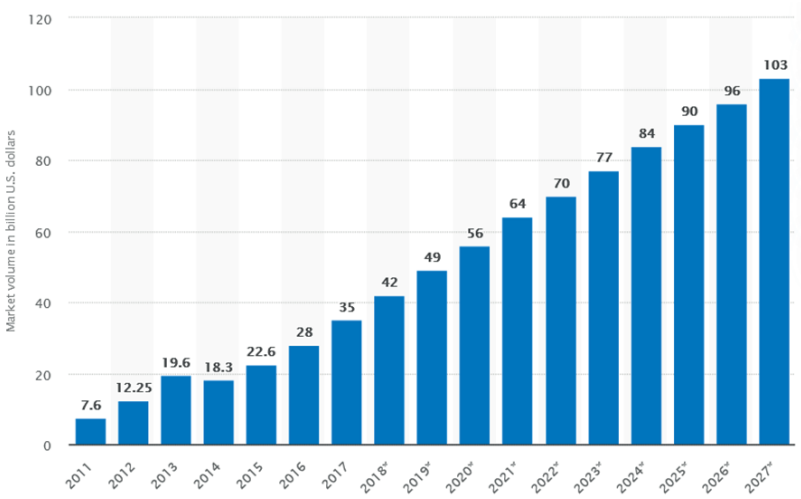

Fig. 11.1 – Forecast revenue big data market worldwide 2011–2027

Source: https://www.statista.com/statistics/254266/global-big-data-market-forecast.

The peculiarity of big data sets is that this resource is inexhaustible. It is not tied to a specific region, so it matters the absolute number of digital traffic generated and consumed, the number of active Internet users, the quality and availability of digital information in a given country. It is clear that under such conditions, developed economies that invest in digital transformation (USA, UK, China, Switzerland, South Korea) will benefit.

In February 2001 Doug Laney, an analyst with the Meta Group, published a research note titled "3D Data Management: Controlling Data Volume, Velocity, and Variety". A decade later, the "3Vs" have become the generally-accepted three defining dimensions of big data, although the term itself does not appear in Laney's note. SAS (Statistical Analysis System) has added two additional dimensions i.e. Variability and Complexity. Further, Oracle has defined big data in terms of four V's i.e. Volume, Velocity, Variety and Veracity. Oguntimilehin. A, presented big data in terms of five V's as Volume, Velocity, Variety, Variability, Value and a Complexity. In 2014, Data Science Central, Kirk Born has defined big data in 10 V's i.e. Volume, Variety, Velocity, Veracity, Validity, Value,

Variability, Venue, Vocabulary, and Vagueness [35]. All the big data characteristics has been listed and defined in Table 11.2.

***Table 11.2* – Big Data Characteristics**

No	Big Data Characteristics	Elucidation	Description
1.	Volume	Size of Data	Quantity of collected and stored data. Data size is in TB
2.	Velocity	Speed of Data	The transfer rate of data between source and destination
3.	Value	Importance of Data	It represents the business value to be derived from big data
4.	Variety	Type of Data	Different type of data like pictures, videos and audio arrives at the receiving end
5.	Veracity	Data Quality	Accurate analysis of captured data is virtually worthless if it's not accurate
6.	Validity	Data Authenticity	Correctness or accuracy of data used to extract result in the form of information
7.	Volatility	Duration of Usefulness	Big data volatility means the stored data and how long is useful to the user
8.	Visualization	Data Act / Data Process	It is a process of representing abstract
9.	Virality	Spreading Speed	It is defined as the rate at which the data is broadcast / spread by a user and received by different users for their use
10.	Viscosity	Lag of Event	It is a time difference the event occurred and the event being described
11.	Variability	Data Differentiation	Data arrives constantly from different sources and how efficiently it differentiates between noisy data or important data
12.	Venue	Different Platform	Various types of data arrived from different sources via different platforms like personnel system and private & public cloud
13.	Vocabulary	Data Terminology	Data terminology likes data model and data structures
14.	Vagueness	Indistinctness of existence in a Data	Vagueness concern the reality in information that suggested little or no thought about what each might convey

These characteristics provide research horizon to the researcher and practitioners in order to effectively manage big data. But some gap still exists which need to be addressed in order to get better insight in the area. These distinct sets encompass different "V's", orbiting the original three. We can safely say we are now well on the way to 100 V's of Big Data and Data Science [36–38].

The main principles of Big Data according to Mayer-Schönberger and Cukier:

1. Absolute accuracy is impossible and unnecessary. With a large amount of information, absolute accuracy is almost impossible and therefore goes into the background. This concept is used to analyze large amounts of data, most of which are constantly in the dynamics.

2. Disorder of big data. The loss of data due to inaccuracies at the micro level is compensated by the unique information obtained at the macro level. The big data that is analyzed is often heterogeneous and of different quality, and can be spread across countless servers around the world.

3. Deviation from the traditional search for causality. When solving a problem, we do not always need to know the causes of certain events. Using the search for correlation between data, new solutions to a problem are discovered. For example, imagine that using correlations between data, we analyzed changes in airfare prices and the number of days before departure. Finding the answer, when it is better to buy the cheapest ticket, you can save money, without having an absolute idea of what is behind their pricing.

4. More efficient data management. The time for searching, collecting and calculating data has been significantly reduced, and in the past years, it is now a few days, or even faster.

5. Using the concept of "dating". Dating is seen as the concept of transforming into a data format everything on the planet, even what at first glance is not perceived as information (such as human location, engine vibration or bridge load), by quantitative analysis.

6. Using the *"N = all"* approach. During the study of various phenomena of social life, we often have to meet with examples of the impossibility of continuous observation, i.e. the study of all units. Due to the high complexity, duration, high cost, continuous monitoring is often economically impractical or virtually impossible. Therefore, in practice, continuous observation, a variety of which is selective, is mainly used. Thanks to the "big data" these difficulties are eliminated and it becomes possible to collect as much information as possible, or even all,

when the number of general population elements *"N = all"*.

Initially, the set of Big Data approaches and technologies included tools for mass-parallel processing of indefinitely structured data, such as NoSQL, MapReduce algorithms and Hadoop project tools. Later, big data technologies began to include other solutions that provide similar characteristics of the processing of ultra-large data sets, as well as some hardware [36].

MapReduce is a model of distributed parallel computing in computer clusters provided by Google. According to this model, the application is divided into a large number of identical elementary tasks that are performed on the nodes of the cluster and then naturally reduced to the final result. MapReduce is a software model and software framework that implements it for distributed parallel processing of large data sets using clusters of ordinary low-cost computers. MapReduce consists of the Map function, which processes key/value pairs and generates a set of intermediate key/value pairs, and the Reduce function, which brings together all intermediate values associated with the same intermediate key. The term "MapReduce" originally meant only Google's proprietary technology, but has now become commonplace and is used to describe a programming model. MapReduce libraries have been created for various programming languages. One of the most popular free implementations is Apache Hadoop.

NoSQL is a general term for various non-relational databases and repositories, not referring to any specific technology or product. Conventional relational databases are well suited for fairly fast and uniform queries, but in complex and flexible queries inherent in big data, the load exceeds the reasonable limits of DBMS usage becomes inefficient. NoSQL is a database that provides a mechanism for storing and retrieving data different from the relationship tables in relational databases. Similar databases existed in the second half of the 1960s, but at that time they had not yet gained the big name "NoSQL", gained after the surge in popularity in the early 21st century, caused by the needs of Web 2.0 companies such as Facebook, Google, and Amazon.com. NoSQL databases are increasingly

being used in big data and real-time web applications. NoSQL systems are also called “Not only SQL” to emphasize that they can support SQL-like structure and query language.

The reasons for this approach include: simplicity of database schema design, significantly simplified horizontal scaling to machine clusters (which is a problem for relational databases), and fine-grained availability control. The data structures used in NoSQL (such as key-value, wide-column storage, graph, document) are from variables than those used by default in relational databases, which makes some data operations much faster on NoSQL. The exact compliance of the use of NoSQL database depends on the problems to be solved. Sometimes the data structures used in NoSQL databases can be considered more flexible than relational model tables. Most NoSQL databases offer the concept of random data matching, in which database changes are duplicated to all nodes “randomly” (usually in milliseconds), so that data queries may not return updated data instantly, or read data may not be accurate. Some NoSQL systems may contain wired or other forms of data loss. Some NoSQL provide the principle of write-ahead logging (WAL) to avoid data loss.

Hadoop is a set of freely distributable utilities, libraries, and frameworks for developing and running distributed applications running on clusters of hundreds and thousands of nodes. It is considered one of the main technologies of big data. Apache Hadoop is a free software platform and framework for distributed storage and processing of large datasets using the MapReduce programming model, in which the task is divided into many smaller isolated fragments, each of which can be run on a separate cluster node consisting of serial computers. All modules in Hadoop are designed with the assumption that the hardware often fails and such situations should be handled automatically by the framework.

The core of the Apache Hadoop system consists of the Hadoop Distributed Filesystem (HDFS) and the MapReduce-based computing system. Hadoop divides files into large blocks and distributes them between cluster nodes. It then

passes the packed code to the nodes for parallel data processing. This approach uses data locality when nodes manipulate only the data they have access to. This allows the data set to be processed faster and more efficiently than in the more traditional supercomputer architecture, which relies on a parallel file system in which calculations and data for them are transmitted over a high-speed network.

The main Apache Hadoop framework consists of the following modules:

1) **Hadoop Common** – contains libraries and utilities needed by other Hadoop modules;

2) **Hadoop Distributed File System (HDFS)** – a distributed file system that stores data on conventional machines, providing very high overall bandwidth on the cluster as a whole;

3) **Hadoop YARN** – a platform responsible for managing computing resources in clusters and using them for user tasks;

4) **Hadoop MapReduce** – implementation of the MapReduce programming model for processing large amounts of data.

Over time, the term Hadoop began to be applied not only to the beforementioned core modules and submodules, but also to the "ecosystem", i.e. a set of additional software packages that can be installed on top of or next to Hadoop, such as Apache Pig, Apache Hive, Apache HBase, Apache Phoenix, Apache Spark, Apache ZooKeeper, Cloudera Impala, Apache Flume, Apache Sqoop, Apache Oozie, and Apache Storm.

R is a programming language for statistical data processing and graphics. It is widely used for data analysis and has actually become the standard for statistical calculations, analysis and graphical representation of data. The development of R took place under the significant influence of two existing programming languages: programming languages S with semantics inherited from Scheme. R is named after the first letter of its founders Ross Ihaka and Robert Gentleman of the University of Auckland in New Zealand. Despite some fundamental differences, most programs written in the S programming language run in the R

environment. R is distributed free of charge under the GNU General Public License as freely available source code or compiled binary versions of most operating systems: Linux, FreeBSD, Microsoft Windows, Mac OS X, Solaris. R uses a text interface, but there are different graphical user interfaces. R has significant capabilities for statistical analysis, including linear and nonlinear regression, classical statistical tests, time series analysis, cluster analysis and more. R is easy to build thanks to the additional features and packages available on the Comprehensive R Archive Network (CRAN) website.

Hardware solutions. Teradata Corporation, EMC offers hardware and software systems designed for big data processing. These systems are delivered as ready-to-install telecommunication cabinets containing a cluster of servers and software for mass-parallel processing. This also sometimes includes hardware solutions for analytical processing in RAM, in particular SAP's Hana hardware and software complexes and Oracle's Exalytics complex, although such processing is not initially mass-parallel, and the amount of RAM of one node is limited to a few terabytes [26, 29, 31, 36–39].

The consulting company McKinsey, in addition to the technologies analyzed by most analysts NoSQL, MapReduce, Hadoop, R, includes in the context of large data applications also Business Intelligence technology and relational database management systems with SQL.

The use of Big Data technologies provides a great competitive advantage and opens up new opportunities, but their use without a deep understanding of a particular area and features of a particular activity is simply impossible. Competitive advantage must be provided by tools, both software and direct analytical. It is obvious that the need for qualified personnel will increase. However, if the IT development of Big Data services can involve trained IT professionals, then great analytics will require specially trained professionals. They must combine knowledge and experience of information technology with knowledge and experience of subject (economics, marketing, management,

finance, etc.) areas. Therefore, it is necessary to modernize curricula and educational programs for training not only IT specialists, but also economic specialties of bachelor's and master's level, in which the basis for mastering Big Data should be the study of disciplines such as: Big Data, Big Data Management, Data Mining, Big Data Analytics and Business Intelligence.

Accelerating the digitalization of Ukraine's economy will create a new quality of life, outline new opportunities for competitiveness in various sectors of the economy, positively affect the purchasing power of the population, make more accessible and better education, convenient digital services and applications, more attractive national economy for skilled workers.

Questions for self-control:

1. Why is Big Data the capital of the digital economy?
2. Explain the terms "Big Data" and "Data Science".
3. How is the history of Big Data related to the Yale University Library?
4. Why did the problem of storing large amounts of data increase after the advent of the Internet?
5. Name the reasons for the introduction of Big Data in the business.
6. Explain why Big Data is considered an inexhaustible resource.
7. Basic principles of Big Data.
8. Discover the meaning of MapReduce technology.
9. Discover the meaning of the NoSQL database.
10. Discover the meaning of Hadoop technology.

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Appendix A

List of transactions that belong to electronic services and those that are not classified as such as of October 1, 2022 according to the Tax Code of Ukraine

Tax Code of Ukraine	
Electronic services:	**Transactions that don't belong to electronic services:**
1) supply of electronic copies, providing access to images, texts and information, including, but not exclusively, subscription to electronic newspapers, magazines, books, providing access and/or downloading of photos, graphic images, video materials; 2) providing access to databases, including the use of search engines and directory services on the Internet; 3) supply of electronic copies (electronic-digital information) and/or provision of access to audiovisual works, custom video and audio works, games, including services provision for participation in such games, services provision for access to television programs (channels) or their packages, except for access to television programs simultaneously with their broadcast through the television network; 4) providing access to informational, commercial, entertainment electronic resources and other similar resources, in particular, but not exclusively, placed on platforms for shared access to information or video materials; 5) distance learning services provision on the Internet, the implementation of which does not require human participation, including by granting access to virtual classes, educational resources in which students perform tasks online, and grades are assigned automatically, without human participation (or with minimal participation); 6) providing a cloud service in terms of providing computing resources, storage resources or electronic communication systems using cloud computing technologies; 7) providing advertising services on the Internet, mobile applications and other electronic resources, providing advertising space, including by placing banner advertising messages on websites, web pages or web portals.	1) supply of goods/services, the ordering (booking) of which is conducted via the Internet, using mobile applications and other electronic resources, and the actual supply is conducted without using the Internet (in particular, accommodation services, car rental, catering services for products supply, public transportation services and other similar services); 2) supply of goods and/or other services, different from electronic ones, which include electronic services only if their value is included in the total cost of such goods/services; 3) distance learning services provision on the Internet, if the Internet is used exclusively as a means of communication between the teacher and the student; 4) supply of copies of scientific, literature and art works on physical media; 5) consulting services provision by e-mail; 6) providing Internet access services.

Appendix B

List of available electronic services on the Diia platform as of 01.10.2022

A

Adoption: candidate registration.

Adult Certificate of recovery from COVID-19.

Adult COVID certificate of negative PCR testing.

Adult COVID vaccination certificate.

Application for a subsidy.

Application for a town-planning conditions and restrictions on land plot development.

Application for getting permanent residence status Diia.City.

Appointment of adequate user.

Automatic sole trader registration.

C

Certificate of acceptance of the object in operation.

Certificate of income.

Certificate of income of a pensioner.

Certificate of no criminal record.

Certificate OK-5.

Certificate OK-7.

Change of place of residence.

Child adoption consultation.

Childbirth assistance.

Children's COVID certificate of negative PCR testing.

Children's Certificate of recovery from COVID-19.

Children's COVID vaccination certificate.

Compensation for employment of IDPs.

D

Damaged property.

Declaring Changes in prices for goods.

Declaration of fire protection.

Declaration of readiness for operation by a court decision.

Declaration of readiness for operation of CC1 objects.

Declaration of readiness for operation based on construction passport.

Declaration of readiness for operation of illegally constructed objects on the land plot of the appropriate purpose.

Declaring place of residence of the child.

Declaration of Waste.

Diia.QR.

Document signing.

e

eDeclaration.

eMalyatko (eBaby).

eOselya (eHousing).

E

Extract about marriage.

Extract from insured persons register.

Extract from the state land.

Extract of death.

Extract on birth.

Extract on dissolution of marriage.

Extract on normative monetary valuation.

Extract on the name change.

Extract on the place of residence.

G

Grant for a garden.

Grant for a greenhouse.

Grant for processing enterprise.

Grant for your business.

I

Information on persons who reviewed information about the land plot.

Information on State Register of rights to real estate.

Information on the landowner.

Inspection of medical reports.

Inspection of road carrier.

Introducing Amendments to food market operators' capacities.

Introducing Amendments to a permit for construction work.

Introducing Amendments to sole trader.

Issuing construction passport.

L

License for auto transportation.

License for Firefighting.

License for import of medical products.

License for sale of pharmaceutical drugs.

License for the production of medicines.

Loan for housing for IDPs.

N

Notification on the commencement of CC1 construction works.

Notification on the commencement of construction works under construction passport.

Notification on the commencement of preparatory works.

O

Obtaining non-profit status.

P

Permit for construction work.

Permit for water use.

Pension recalculation.

R

Receiving microgrant from EU4Business.

Registration of food market operators' capacities.

Registration of LLC under the model Articles of Association.

Re-issuance of birth certificate.

Re-issuance of certificate of name change.

Re-issuance of death certificate.

Re-issuance of marriage certificate.

Re-issuance of marriage dissolution certificate.

Removal of place of residence.

Renewal and exchange of driving license.

Request of individual license plate.

Request of permits on the international transportation of goods.

Retirement.

S

State registration of rights to real estate.

T

Tax return of single tax payer.

Transference of a legal entity to work under the model Articles of Association.

Termination of a permit for construction work.

Termination of non-profit status.

Termination of Notification on the commencement of preparatory works.

Termination of registration of food market operators' capacities.

Termination of sole trader.

DigEco

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