ARTIFICIAL INTELLIGENCE: AN ERA OF NEW THREATS OR OPPORTUNITIES?

Monograph

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ARTIFICIAL INTELLIGENCE: AN ERA OF NEW THREATS OR OPPORTUNITIES? monograph. Edited by Irina Tatomyr, Liubov Kvasnii. Praha: OKTAN PRINT, 2023, 260 p.

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1. EMERGING PARADIGMS: THE FUSION OF AI AND ECOSYSTEMS IN BUSINESS

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Under rapid technological advancement, the influence of artificial intelligence (AI) on companies' business models has emerged as a transformative force reshaping the fundamental fabric of organizations and promoting new forms of business activity coordination. The convergence of cutting-edge technologies and innovative business strategies is propelling companies into unknown domains, transcending traditional operational paradigms and unveiling new frontiers of value creation.

This research delves deep into the complex interplay between artificial intelligence, digital operating models, and business digital ecosystems. With AI poised to revolutionize decision-making, automation, and customer engagement, digital operating models acting as the structural backbone of organizational operations, and business digital ecosystems fostering collaborative synergies, understanding how these elements interact and influence each other has become pivotal for businesses striving to remain competitive in today's fast-paced environment.

As evidenced by the literature review on the topic of our study, researchers delve into various dimensions of AI's integration into business operations. Their studies encompass investigating the symbiotic relationship between AI and business ecosystems, particularly in the context of digital transformation. Scholars like A. Kindler, J. Moore, A. Fletcher, M. Jacobides, M. van Alstine, M. Koch, D. Kromer, Pidun U., Reeves M., and Schüssler M. J. Coufano, M. Ianciti, K. Lakhani, S. Gupta, and others, have illuminated these facets.

Their research explores how AI influences business models, spurring a paradigm shift towards more adaptive and data-driven strategies. Moreover, these inquiries examine the intricate ways AI augments ecosystem design and restructuring and how it redefines the positioning of businesses within these dynamic landscapes.

As AI gains prominence, researchers are extending their focus to explore innovative methods for harnessing AI in orchestrating services within business ecosystems. Their investigations study how AI optimizes processes, enhances decision-making, and propels innovation in these interconnected networks. Significantly, researchers analyze the models of digital business ecosystems through the lens of AI's transformative potential and inspect how AI impacts market dynamics, enabling ecosystem companies to align their offerings with ever-evolving customer preferences. The intersection of AI and business ecosystems serves as a

critical nexus for exploring new avenues of growth and differentiation. As this field advances, it underscores the imperative for businesses to embrace AI-driven strategies to navigate the complexities of digital business ecosystems effectively.

Modern digital technologies are progressively erasing the traditional boundaries of economic sectors, including industries, agriculture, transport, communications, and finance. In particular, the advent of artificial intelligence (AI) is catalyzing transformations in the business model (determining the company's value proposition to customers, offerings, and revenue generation) and the operational model (how enterprises achieve their customer value proposition and income monetization). The outlined changes form a new organizational model. Let us consider its theoretical basis.

A characteristic feature of the organization is to ensure coordination and form a hierarchy in the motivations of participants to unite them into a system that ensures the speed of decision-making and the effectiveness of their implementation. That is, the organization uses the interdependence of the motivations of its members, revealing in this way the interdependence of their functions. A firm is a particular case of an economic organization.

C. Menard [1], within the framework of organization theory, observes that a firm gauges its economic success by increasing its activity volume and being able to replace the market. The final criterion of a firm's effectiveness involves the impact of the organization on its environment: an effective organization changes the external environment to its advantage.

The Coase Theorem explains the limits to growth that baffle many companies, large and small. A company can grow if its internal costs, including all costs, are lower than its external costs. Once internal costs equal or exceed external costs, the company will reach a point of diminishing returns and stop expanding.

New digital technologies increase the pressure associated with the Coase theorem by reducing external costs. Some observers believe that these technologies will put an end to large companies. Search engines, for example, have made it much easier and cheaper to obtain information than in the past and thus destroyed the advantage previously held by large companies with extensive resources.

However, digitization also reduces internal costs for companies that use technology effectively. It changed the economics of internal organization. For example, cloud services provide high levels of performance without the need for staffing and high capital investment when temporary expansion is required. Amazon, Microsoft, and Google web services have already capitalized on this trend, and such services are likely to proliferate. Some companies are already building technological platforms that link all parts of their enterprise and production chains to achieve lower costs than previous IT projects.

As digitization continues, transaction costs will continue to fall. This process will influence decisions about retaining activities within the organization and outsourcing others to the contractor. Some processes that used to be cheaper within companies will become more expensive, like research and development support. Meanwhile, things that used to be profitable to outsource, such as HR and training,

may become less expensive internally because simplification of hierarchies allows for less formal (and therefore less expensive) HR management and recruiting. However, the basic equation will remain the same: the lower the company's internal costs compared to its external costs, the more likely it is to grow [2].

The next concept which explains the nature of the new organizational model is the concept of modularity, developed by Harvard Business School professors Carlisse Baldwin and Kim Clark in the late 1990s [3]. They noted that modularity, or modular design, was a crucial factor in the speed of innovation. Companies use modularity in software development, automotive design, and other engineering aspects. Thanks to it, a complex technological design penetrates many functionally relevant components - standardized, where standardization is required, and individually designed, where differentiation is necessary.

The concept of modularity also applies to companies. Modular organizations can innovate faster than others because the slowest divisions or products do not hamper their R&D pace. For instance, the Amazon company has created a structure that allows it to offer a wide range of products at a lower cost than its competitors. This structure lets the online retailer masterfully enter new industries and develops new offerings, including its modular Amazon Cloud infrastructure.

The organization can achieve modularity by creating separate research laboratories without isolating each other. However, it requires attention to the structure of the R&D activity: making some processes and practices generic (such as procurement of materials and the use of cloud-based software platforms) and others completely isolated (such as unique features of hardware and software that should not be shared with competitors). Today, as businesses go from analogue to digital, modularity is essential because speed and flexibility are essential.

In general, these theories[1] explain the choice of organizational structure, ways of cooperation, and distribution of functions and resources, which are essential components for the successful functioning of digital business models and will determine the internal architecture of companies. Now, we will consider the changes in a company's business model and operating model that integrates artificial intelligence into creating value for its clients. The degree and extent of digital technologies integration within the firm's business model distinguish between digitally enhanced and digitally enabled business models.

As G. Coufano [4] notes, a digitally-enhanced business model refers to a model in which digital technologies are integrated into existing processes, operations, or products to improve specific aspects of the business. In this context, digital tools augment or improve certain functions without necessarily undergoing a complete transformation. It focuses on leveraging digital capabilities to optimise efficiency, productivity, or customer experience within the existing framework.

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[1] In addition to the ones we have considered, several other theories are essential for understanding and analyzing the dynamics of the digital economy. Network effects, platform economics, information asymmetry, and innovation diffusion theories provide insights into how digital technologies, platforms, and ecosystems shape economic activities, business models, and societal changes.

At the same time a digitally-enabled business model goes beyond enhancement by incorporating digital technologies as a fundamental and strategic component of the entire business model. It involves a more comprehensive transformation of how the business operates, serves customers, and creates value. Digital capabilities are deeply integrated throughout various functions, resulting in a holistic rethinking of processes, products, and services. This approach fully leverages digital technologies to create new opportunities, explore innovative revenue streams, and disrupt traditional business paradigms.

In summary, the primary difference lies in the scope and depth of integration of digital technologies within the business model. Digitally enhanced models focus on improving specific areas, while digitally enabled models involve a more profound shift in how the business functions and interacts with its environment. Both approaches acknowledge the importance of digital transformation, but the extent of change and impact on the overall business strategy sets them apart.

Generally, as M. Iansiti and K. Lakhany define in [5], the task of the operating model is to create profitable offers at the correct scale (the volume of production of goods and services, the number of clients served by the firm), to achieve a significant scale (the range of activities that the firm performs), and to respond to changes by resorting to appropriate training (the firm's operational ability to improve and innovate). For a long time, operational strategy researchers believe the firm achieves efficiency in its activities by coordinating its strategy and operations to implement it, specifically when the operational and business models are coherent.

Expanding one of the three dimensions of the company's operational activity complicates its operating model, making its management even more difficult. Such a limitation constrains the company's activities concerning its ability to generate profitable client offers and secure funds. Embedding digital technologies in the process of creating value for the customer allows the company to overcome these limitations, achieving a new level of scaling, significantly greater scope and learning opportunities, and faster adapting to the turbulent external business environment.

The digitized operating model emerges from the company's transformation of the crucial path for delivering value to customers, employing software or data-based algorithms to replace human labour as the constraining factor in the company's operational growth. The marginal cost of serving an additional user in many digital networks approaches zero, except for certain additional costs of computing power in cloud environments. These aspects make it easier to scale the digital operating model. Limitations to the company's growth are much less dependent on people and organizational obstacles because most operational complications can be solved through software and analytics and the involvement of third-party partners from the company's existing network of partners.

The digital operating model is also changing the firm's architecture thanks to the modularity of digital technologies [2;3], which enables the rapid adjustment of business relationships. The digitized process can be easily connected to external partner networks and providers to create additional value for the company's client. That is, digital processes are multifaceted. Also, the digitization of the operating

model can create opportunities for rapid learning and innovation. The variety of accumulated data and their quality processing allow, for example, to personalize the application or introduce innovations in developing new products. Thanks to the digitized operating model, the need for many employees and bureaucratic procedures is reduced.

As it is noted [5] in a digital operating model, employees do not provide a service or product. However, they design and control software automation, overseeing a digital organization driven by algorithms that deliver the goods. Constraints on growth are transferred to the technology layer or the ecosystem of partners and suppliers.

Ecosystems in the business realm, especially within the digital domain, are gaining increasing significance due to transformative shifts in the economy, propelled by the following factors. First, regulatory changes and the wave of digital transformation have blurred the distinctions between goods and services. Secondly, the abrogation of legal documents has nullified exclusive privileges previously held by specific firms to cater to client needs. Third, modern technologies have revolutionized firms' capacity to serve their clientele. The prevalence of mobile devices and the Internet's pervasive influence on consumer behaviour have expanded the avenues for connecting formerly disparate goods and services, amplifying the impacts of the initial two factors [6].

Considering these transformative developments, individual firms frequently find themselves unable to autonomously create all the components of a comprehensive offering tailored to client needs, let alone experiment with diverse combinations of these elements across various markets. In fact, in numerous sectors, the firm, and even the industry, no longer serve as distinct units for strategic analysis.

In this context it is necessary to incorporate a universally accepted definition of a business ecosystem. However, R. Adner [7] distinguishes two primary approaches to investigating ecosystems: 1) the affiliation approach; and 2) the structural approach. Under the scope of the first approach, researchers perceive an ecosystem as a community of interconnected actors, wherein the pivotal element is the intricate network of relationships. Ecosystems manifest in the economic landscape due to the diminishing boundaries among conventional industries, leading to amplified interdependencies and symbiotic interactions among participants throughout the value-creation process. The second approach, conversely, regards the ecosystem as a configuration of diverse activities intended to generate consumer value. In this perspective, participants deliberately organize ecosystems to achieve shared objectives, bringing them to fruition through a carefully devised business strategy.

Consequently, our research primarily focuses on the second approach to interpreting business ecosystems, framed as a conscious strategic choice for collaborative value creation with other participants in the market. We will use digital business ecosystems rooted in information, communication, and digital technologies to illustrate this approach.

In 2002, the General Directorate of the Information Society of the European Commission conducted studies that marked one of the initial attempts to conceptualize the digital business ecosystem [8]. They defined the digital business

ecosystem as an outcome of socioeconomic development driven by information and communication technologies. Simultaneously, they emphasized the co-evolution of the tangible business ecosystem (a community of producers, suppliers, and consumers) and its technological counterpart, the digital ecosystem. This relevance was particularly notable in markets characterized by high fragmentation, including those within the European Union.

Subsequently, the concept gained traction during discussions at the World Economic Forum in Davos [9]. Notably, the forum featured the presentation of an analytical report titled "Platforms and Ecosystems: Enabling Opportunities for the Digital Economy." This report defined the digital business ecosystem: as a community of organizations engaged in mutual interactions facilitated by digital technologies, primarily operating based on modularity principles, and characterized by a non-hierarchical management approach (in contrast to the traditional supply chain model).

The consulting firm Gartner Research [10] delineates a digital business ecosystem as an interdependent assembly of enterprises, individuals, and entities that employ standardized digital platforms to pursue shared objectives, such as commercial gains, innovation, or common interests. Alphabet, an ecosystem-driven company, views digital business ecosystems as networks of production connections underpinned by modern, chiefly cloud-based digital technologies.

In a study by M. Koch, D. Kromer, and others [11], the digital ecosystem is portrayed as a socio-technical system that unites autonomous providers and consumers of assets, thereby generating mutual benefits through digital platforms that enable scaling and harnessing positive network effects.

Upon analyzing these definitions, three distinct components of the digital business ecosystem emerge:
– a community of developers, serving as a space for value creation;
– a digital platform acting as a resource for shared use;
– a business ecosystem functioning as a realm for the commercialization of innovative offerings.

From an economic theory perspective, digital platforms represent multilateral markets that leverage digital technologies to unite diverse participant groups. It is essential to note that a digital ecosystem encompasses a broader concept than a digital platform, as it simultaneously unites multiple markets, each with distinct participant groups.

Within the framework of the second approach, the ecosystem functions as a collaborative mechanism through which participating firms (including suppliers, distributors, outsourcing entities, manufacturers of related goods or services, and technology providers) pool their products to form a complex structure oriented towards meeting customer needs. There is no universally established formal definition for the digital business ecosystem at the legislative level across countries. Typically, state regulatory bodies allocate specific indicators that offer a partial understanding of these economic entities yet fail to comprehensively identify them,

thus hindering the subsequent normative and legal regulation of their operational rules.

Based on empirical observations from management and business practices of companies adopting an ecosystem approach to create valuable consumer offerings, researchers [11; 12] have established several criteria for distinguishing the digital business ecosystem from other forms of business organization, such as vertical integration, hierarchical supply chain, and open market models.

In recent research by Koch, M., Krohmer, D., Naab, M., Rost, D., Trapp, M. [11], several critical criteria have been identified that shape the dynamics of digital business ecosystems:

1.   Servitization: Digital business ecosystems emphasize integrating services with product offerings or even shifting towards primarily offering services to consumers. Unlike the traditional model where software was embedded in products, these ecosystems incorporate products, goods, and services into network structures through software. Companies now prefer to provide services over producing capital-intensive products.

2.   Network Effects: The scalability of ecosystems is primarily driven by network effects. These effects manifest as the expansion of the user base leading to increased ecosystem value. This positive feedback loop significantly enhances the scalability of the ecosystem.

3.   Out-of-Firm Value Creation (Inverted Firm Effect): Unlike traditional ecosystems, companies within digital business ecosystems collaborate with a network of autonomous participants to create value for consumers. This shift represents a move from the traditional vertical integration model towards a more open organizational structure.

4.   Winner-Takes-All Effect: Digital business ecosystems often dominate markets once they reach a certain threshold, owing to their flexibility, dynamic growth, and the strong impact of network effects.

5.   Ecosystem Openness: Striking the right balance between openness and restricted access to the ecosystem is a common dilemma. The degree of openness chosen significantly impacts the innovation and functioning of the digital ecosystem. From a technical standpoint, ecosystem openness also involves access to relevant technology, such as source code.

6.   Collaboration: Digital ecosystems foster collaboration across industries, companies, and organizations. The effectiveness of digital ecosystems raises questions about the balance between competition, cooperation, and a mixed model of inter-firm interaction.

7.   Utilization of Unused Assets: Digital business ecosystems enable the utilization of previously unused assets, expanding markets through the rental of access to products that consumers used to purchase.

On the other hand, Pidun U., Reeves M., and Schüssler M. [12] identified the following criteria that characterize the workings of digital business ecosystems:

1.   Modularity: Ecosystem components for consumer offerings are developed independently yet function cohesively. Customers can choose options and

combine them, as seen in smartphones with pre-installed applications alongside user-selected installations.

2.   Customization: In a business ecosystem, customization involves tailoring offerings to specific requests. Ecosystem participants seek mutual compatibility for their products, leading to adaptations and ensuring compatibility within the ecosystem.

3.   Multilateral Relationships (Multilateralism): Ecosystem participants establish complex relationships beyond simple bilateral interactions. For instance, an ecosystem's marketplace or delivery service collaborates simultaneously with suppliers, payment systems, app developers, and other participants.

4.   Coordination: Unlike the vertical integration or supply chain model, a business ecosystem cannot be hierarchically managed from top to bottom. Instead of being achieved passively, coordination occurs actively through establishing and implementing appropriate standards, rules, or processes. For digital platforms, companies typically actively regulate access and interactions using application programming interfaces (APIs).

J. Parker and M. van Alsteen [13] noted that the inverted firm's effect involves shifting the value creation process from within the company to its ecosystem partners. Network effects facilitate this transition, making it easier to scale externally than within the firm. After all, the number of customers surpasses the number of employees. Companies are transitioning from a form of vertical integration to becoming open organizations.

Modularity, as defined by [14], enables the creation of complex systems by combining more minor elements, ensuring their strategic flexibility, and shaping the structure of the business ecosystem. Moore's perspective indicates that increasing modularity levels result in a more considerable number and variety of companies participating in the ecosystem.

Simultaneously, ensuring the internal coherence of modular elements requires coordination, achieved through a system of standards, rules, and interfaces. Ecosystem participants also enjoy a certain degree of freedom in specific parameters, such as product design and pricing.

The study revealed ongoing efforts in classifying digital business ecosystems. Currently, criteria such as the model of value formation, degree of openness, construction approach, and scaling direction of the vital ecosystem product serve as classification factors for the business ecosystem.

Various ecosystems exist within the digital business landscape, each characterized by distinct features and functionalities. Let us explore different ecosystem types. Criteria for the classification of digital business ecosystems in research are the model of value formation, the degree of openness, the approach to building the ecosystem, and the direction of scaling the critical product of the ecosystem.

According to the model of consumer value formation in the context of the digital business and operating models, a conceptual distinction can be made between decision ecosystems and transaction ecosystems. This framework delves into the

intricate processes through which consumers perceive and derive value from their interactions within digital environments.

Decision ecosystem focuses on creating or providing products while coordinating the involvement of multiple market participants. It also involves managing offerings from complementary companies, thereby generating components that enhance the main product. A prime example is the collaboration between BMW Group and Daimler AG in jointly developing a strategy for the autonomous vehicle market, creating a consumer-oriented product.

Transaction ecosystem connects independent producers of goods or services directly with customers via a unified platform. The value of such an ecosystem grows in direct proportion to expanding its customer base. Notable instances include eBay, a platform linking independent product and service providers with customers, and Uber, enabling passengers to find available taxis conveniently. Additionally, Upwork plays a crucial role in assisting companies in finding freelance workers.

From the perspective of ecosystem construction, we differentiate between multi-actor and multi-product ecosystems. Multi-product ecosystem incorporates products from a single corporate entity, often organized through separate divisions or independent entrepreneurial entities. Interconnected economic relationships exist among these products, leading to the possibility of being substitutes or even essentially inseparable from a demand perspective.

In multi-actor ecosystem, independent participants actively collaborate to co-create value, surpassing the capabilities of individual companies. This concept finds its best representation in two-sided and multi-sided platforms that actively bring together diverse participants for value creation.

The direction of essential ecosystem product scaling distinguishes vertical, horizontal and hybrid ecosystems.

The vertical ecosystem focuses on a critical core product offering that significantly contributes to business revenue while providing benefits to the customer. A notable example is a flight ticket search service, which assists in flight bookings and offers additional services such as lodging, tours, car rentals, and restaurant reservations.

The horizontal ecosystem scales its core product to encompass adjacent market segments. New services address additional user needs and further support the primary product of the ecosystem. For instance, the PayPal ecosystem, driven by financial operations and money transfers, spans multiple sectors, serving individuals, small and medium businesses, and large enterprises with tailored services.

A hybrid (omnichannel) ecosystem is a unique ecosystem that seamlessly integrates diverse channels and services into a unified system. This integration provides users with continuous communication while maintaining a seamless experience. Noteworthy examples include WeChat, which functions as a messenger while offering access to government and financial services, smart home functions, social networks, gaming, and online shopping. Amazon amalgamates diverse services, encompassing retail, logistics, user technologies, cloud computing, media, and entertainment.

The degree of Ecosystem Openness determines open and closed ecosystems. In the open ecosystem scenario, third-party developers can create and publish digital products on the ecosystem platform, and third-party participants can offer their goods on the ecosystem's marketplace.

A closed ecosystem is characterized by a platform featuring products exclusively created by the organizing company and its associated developers. A prime example is Nike's user ecosystem, built upon data obtained from FuelBand Nike devices. This ecosystem is cohesive, providing users with information and advice on sports achievements, training regimens, and maintaining a healthy lifestyle.

These diverse types of digital business ecosystems highlight the complexity and innovation within this dynamic field. Each type offers unique strategies for value creation, participant engagement, and market expansion.

It must be admitted that digital business ecosystems exhibit characteristics of different types simultaneously. Notably, Big Tech companies employ multiple ecosystem types. The practice of management increasingly observes the hybridization of ecosystem forms. For instance, the Apple iPhone ecosystem initially functioned as a solution ecosystem, with Apple, as the primary firm, orchestrating interactions between component suppliers, application developers, and telecommunications providers. Subsequently, the App Store emerged as a platform for selling mobile applications.

Similarly, Airbnb originated as a transactional ecosystem but later expanded into a solution ecosystem, inviting external developers to integrate supplementary applications and services into the platform (e.g., tools for trip organization or simplifying guest registration, cleaning, or laundry delivery). After its acquisition by Microsoft [12], the LinkedIn platform transitioned into a solution ecosystem. Alphabet, the parent company of Google, employs a combination of multi-product and multi-actor ecosystems for Google and Google mobile services (mobile devices).

Conclusion. In conclusion, as we reflect on the evolving landscape of economic expansion and technological integration, it becomes evident that the principles articulated by Ronald Coase decades ago remain remarkably applicable in today's digital era. Coase's insights highlight the advantages of internal production processes over market reliance under cost-effective circumstances and continue to resonate within our modern digital landscape.

Central to this landscape is the pivotal role of artificial intelligence (AI), which has become a cornerstone of contemporary company architecture. Its influence extends beyond mere technology, shaping firms' structure, operational strategies, and value-creation mechanisms within the dynamic milieu of digital business ecosystems. AI empowers firms to adapt to ever-evolving customer demands and respond nimbly to rapid shifts in the market while harnessing the strategic potential of data.

Distinct from conventional modes of economic coordination, such as vertical integration, hierarchical supply chains, and open markets, the digital business ecosystem functions as a fluid network, absent fixed structures or boundaries. Its evolutionary path is propelled by the dynamic interplay of scale effects on the demand side, drawing new participants— from consumers to entrepreneurs and developers—into its orbit. The actual assets of this ecosystem lie in the intricate web

of connections among participants, and the data flows they generate. Organizing companies assume a regulatory role in this complex environment, overseeing participant relationships through established standards, rules, and interfaces.

Practically speaking, digital business ecosystems have gained substantial prominence in contemporary conditions. Across diverse sectors of the economy, companies recognize the value of tapping into external resources to meet the escalating demands of customers. This shift underscores the increasing importance of these ecosystems as transformative conduits for business growth and innovation.

Modern companies face challenges and opportunities at the intersection of Coase's enduring principles and the AI-driven dynamics of digital ecosystems.

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2. CONTROLLING IN THE MANAGEMENT OF RETAIL TRADE TURNOVER

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Today, the controlling is increasingly used in the management practice of domestic enterprises of various sizes and spheres of economic activity, although their organizational structure does not always have a division of the same name. But the main thing is that modern business entities have realized the advantage of using this concept and introduce and implement the methodology and principles of the controlling.

Certain developments that deal with the implementation and functioning of controlling and determining the place and role of control in the controlling system are reflected in the works by Ukrainian scientists, in particular: O. Karminskyi, N. Olenev, L. Sukhareva, S. Falko, O. Tereshchenko, D. Morozov, A. Pryimak, Y. Yakovlev, M. Bilukha, A. Bodyuk, F. Butynets, V. Murashko, E. Romaniv, N. Shulga and others. Speaking of foreign scientists, special attention should be paid to the best practices of the following scientists A. Dale, Y. Weber, E. Mayer, R. Mann, D. Han, P. Horvat and others. In these scientific works, there is practically no systematic approach to the study of the problems of controlling and control in the controlling system of the management of commercial business entities. M.V. Tarasyuk [1] studied the problems of implementing control in the management of commercial business networks. Sytnyk H., Silakova H., Blazhenko S. [2] considered the theoretical and methodological basis of the formation of the control system of operational activity in trade.

Commercial business as one of the dynamically developing sectors of the economy has a number of typical economic, social, organizational, technical characteristics and other features that determine the specifics of the controlling system. The main ones are as follows: the integration nature of commercial business; the specificity of commercial business services; the duration of the operational cycle; features of the trading and technological process; features of the organizational structure of commercial business enterprises; differences in the structure of assets of commercial business enterprises in comparison with enterprises of other economic activity types; the structure of fixed assets; much greater need for current assets; cost structure; large share of inventory custodians; fast return on investment; large labor intensity of the industry; the effectiveness of the industry largely depends on the personal psychological qualities of employees, their qualifications, knowledge and

experience; the dependence of the industry on the purchasing power of the population; heterogeneity, complexity of the structure and the branching of the retail network; seasonality of sales of many goods; intensive growth in the volume of additional services provided by retail establishments. All these features of the functioning of commercial business impact the construction of a controlling system at commercial business enterprises.

German scientists have identified the following areas of controlling commercial business companies [3, p. 29]:

- general controlling (financial controlling, organizational and strategic planning, investment controlling, branch management, development of various types of enterprises, general customer management);
- personnel controlling (flexible personnel planning and performance measurement by "scanning", "skills controlling");
- product range controlling (product range planning, regulation, and control);
- controlling the areas used (management of the use of areas based on scanning analytical data on the efficiency of using areas, area management systems);
- warehouse management controlling (order system, external logistics system, internal logistics system, acceptance of goods and coordination of warehouse operation, shipment of goods).

Practitioners, when studying the problems of building an effective sales management system, mainly focus on the study of such four aspects as sales planning, organization of the sales process, sales motivation and sales control. At the same time, sales control is not limited only to monitoring indicators for trade turnover and customers but also directly controls the sales process.

Studies of several Ukrainian scientists have shown a significant role in such aspects as the management of trade turnover, goods supply, inventory, circulation costs, commercial income, financial results, etc. in the management of retail establishment trade activities. Features of the listed functional areas of trade management require appropriate adjustment of controlling objects and methodological tools for retail enterprises.

Despite the high relevance of the studied problems, the scientific literature has not covered the issue of controlling the management of trade turnover of retail establishments.

Any management function is necessarily integrated with the control one, therefore, it can be argued that control is an integral element of each stage of the management process and a separate stage that provides information transparency of the quality of the management process at all other stages. Having regard to the aforementioned, the concept of control can be interpreted both in a narrow sense, that is, as one of the stages of the management process, or as one of its functions, and in a broader sense, that is, as a system (which is part of the enterprise management system), which consists of a number of elements.

In the publications of practicing experts and the works of scientists we find a description of various tools for controlling the sales sphere of a retail establishment:

✓ marketing and sales controlling; sales controlling; commercial controlling;

✓ internal control of sales activities (sales control);

✓ sales system monitoring (sales monitoring); monitoring the achievement of sales volume targets; customer monitoring;

✓ retail audit; marketing audit; distribution (sales) audit; sales management audit;

✓ rapid diagnostics of the sales system;

✓ control of a sales department management; audit (monitoring) of the sales department;

✓ controlling of the trade turnover (revenue);

✓ accounting, audit, and trade turnover audit;

✓ control (monitoring) of the trade turnover plan.

As can be seen, in relation to the sales sector, the literature considers such controlling tools as controlling, internal control, monitoring, audit and rapid diagnostics.

We cannot but note the proper study, first of all by practitioners, as well as scientists, of the problems of controlling the sales sector with a detailed description of objects, techniques, tools, etc. However, controlling as a technology in managing the trade turnover of a retail establishment, which primarily focuses on performance parameters in relation to process management, has not yet found its scientific justification.

M. V. Tarasiuk considers trade turnover controlling as one of the types of controlling in the management of retail networks based on the functional direction of management it supports. The author determines that controlling the trade turnover ensures the fulfillment of the goals of the retail network in the field of selling goods and providing paid trade services to individuals to meet their personal consumer needs, as well as legal entities to perform further processing or resale where the main tools are the research of the volume and structure of trade turnover; assessment of the factors that affect the volume and structure of trade turnover, determining the "break-even point" and "minimum profitability point", determining the optimal volume of trade turnover and others) [1, p.146-147].

In our opinion, controlling trade turnover is not effective if there are no references made to factors and processes associated with trade turnover. As a matter of fact the control of trade turnover as an effective indicator of the retail establishment's activity is carried out after the fact at the end of the established time period, and the control of the sales process makes it possible to understand before this period ends whether it is possible to achieve certain goals of trade turnover management and take unscheduled measures to ensure they are achieved.

The characteristic of controlling trade turnover (revenue) in most cases is associated with the creation of a revenue center at the enterprise, which is a division whose head is responsible only for revenue but not for expenses (for a limited amount of expenses), for example, a distribution department that is responsible only for the cost of selling products. Since the main purpose of the sales division of a retail establishment is to sell goods to the end user, performance of the functional duties by employees of this division will mean trade turnover to be obtained. That is, from a

financial point of view, this division generates income and, therefore, is a center of income.

If the structure of a sales division is constructed by product specialization, the part of the division that sells a certain product (product group, product category) can become a separate center of financial responsibility for the income from the products (product group, product category) in the corresponding business area.

However, the sales division incurs the costs of employees' wages, advertising, rent, etc. In this case, you can create two responsibility centers based on this division, which are to be the income center itself, where income will be accounted, and the cost center, where expenses will be accounted. Depending on the targets that determine the subject of center responsibility, there are two possible options for the responsibility of the sales department for expenses:

1) Financial accounting center is a structural division that records the income and/or expenses established for it but is not responsible for their amount;

2) Expenses incurred by the sales division are generated independently, and their amount affects the volume of trade turnover received (for example, advertising costs).

In our opinion, the budget of the Cost Center of the sales division should contain planned volumes for items of circulation costs.

The authors of the textbook "Economics of a Commercial Business Enterprise" define control (monitoring) over the implementation of planned targets as the last stage of the procedure for managing the trade turnover of a commercial business enterprise. At this stage, they compare the achieved results with the planned indicators, make the necessary adjustments to the previously developed plans and policies of the enterprise in order to provide conditions to implement the developed trade turnover plan and obtain the maximum possible amount of commercial income and profit [4, p. 124]. In our opinion, control (monitoring) of the trade turnover plan acts as one of the controlling functions in managing the trade turnover of a retail establishment.

To date, the category of "controlling" does not have a clear definition despite that fact that there are numerous studies available. The plethora of opinions about the essence of the term "controlling" is primarily related to its consonance with another economic term, which is "control", in its understanding as a process of comparing the actual performance indicators of a business entity with planned or budget indicators. According to modern researchers, the semantic load of the term "controlling" is not limited to control. In addition, the differences in the definitions of controlling refer the time aspect.

With respect to the aforementioned, we think it appropriate, without delving into the etymology of the content of the term "controlling", to consider its current understanding and the specifics of the definition, taking into account the industry features of the activities of commercial business enterprises.

Nowadays, the scientific community opines that it is relevant to consider that controlling provides management support and synthesizes management functions. The concept of "controlling process" reflects the dynamic side of controlling and is characterized by a certain sequence of actions, which, when taken, ensure the

achievement of the goal. Consequently, based on the understanding of controlling as a management support function, we can conclude that the process of its implementation is closely related to the management process (Fig. 1).

Management process

Goal setting	Situation	Problem	Solutions
Information and methodological support	Assessment of the actual state of the system	Area determination	Development of recommendations

Controlling process
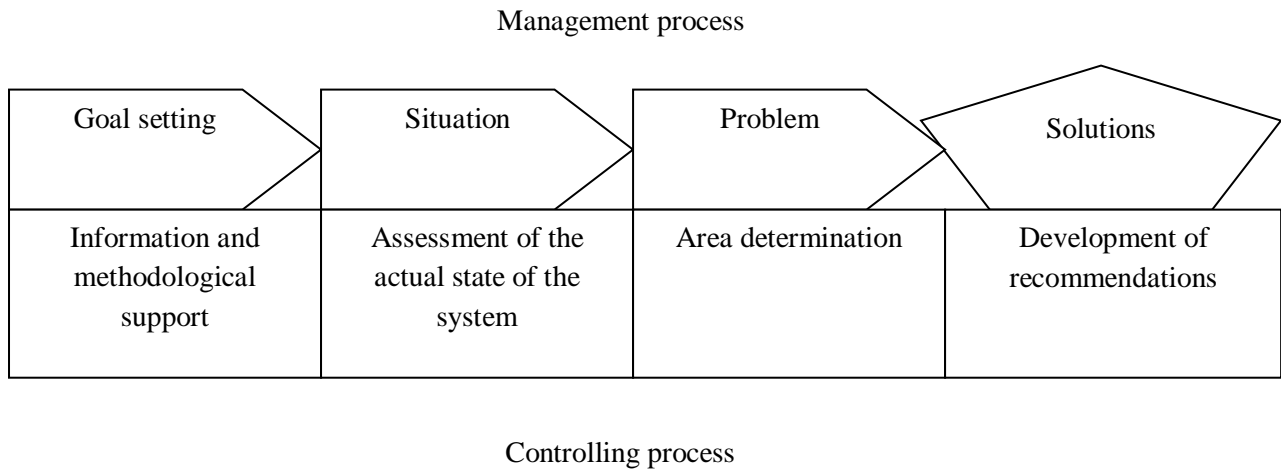
Figure 1. Interrelation of management and controlling processes

On the grounds of this, the controlling cycle in the management of trade turnover of a retail establishment includes systems of information support, accounting, reporting, planning, regulation, and adjustment of plans and control.

As defined by M. V. Tarasiuk, controlling is a management technology that ensures the achievement of the mission and strategic goals of the enterprise, covers all areas of activity, business processes and business enities, facilitates effectively managing the business entity not only in real time but also its future activities, as well as contributes to the development of communications at the enterprise through the creation of an appropriate information support system, service support for the implementation of all management functions, the study and dissemination of positive management experience, research and synthesis of advanced theoretical scientific developments in the field of management, marketing, economics, finance, analysis, logistics, investment, innovation and so on, constant monitoring of key performance indicators of an enterprise that is capable of adaptation, self-development and self-improvement, which is provided by direct subordination of the controlling service to the top management of the enterprise and independence from managers of lower levels [1, p.76].

Thus, the introduction of controlling and the use of controlling tools at commercial business enterprises will optimize and increase the efficiency of planning, organizing, controlling, monitoring, and regulating the company's activities based on the development of recommendations for making informed management decisions.

Taking into account the aforementioned and based on the approaches to understanding the essence of marketing and sales controlling, we propose to define controlling in the management of trade turnover of a retail establishment as a management technology based on the coordination and integration of the efforts of relevant departments and the use of modern information technologies to obtain timely and relevant information about trade turnover indicators, factors and processes

associated with trade turnover obtained, to make efficient management decisions aimed at achieving set goals of managing of trade turnover of a retail establishment in the current and future periods. Controlling provides coordination of all management activities to achieve set goals of managing the trade turnover of a retail establishment as permanent changes occur in the internal and external environment (Fig. 2).
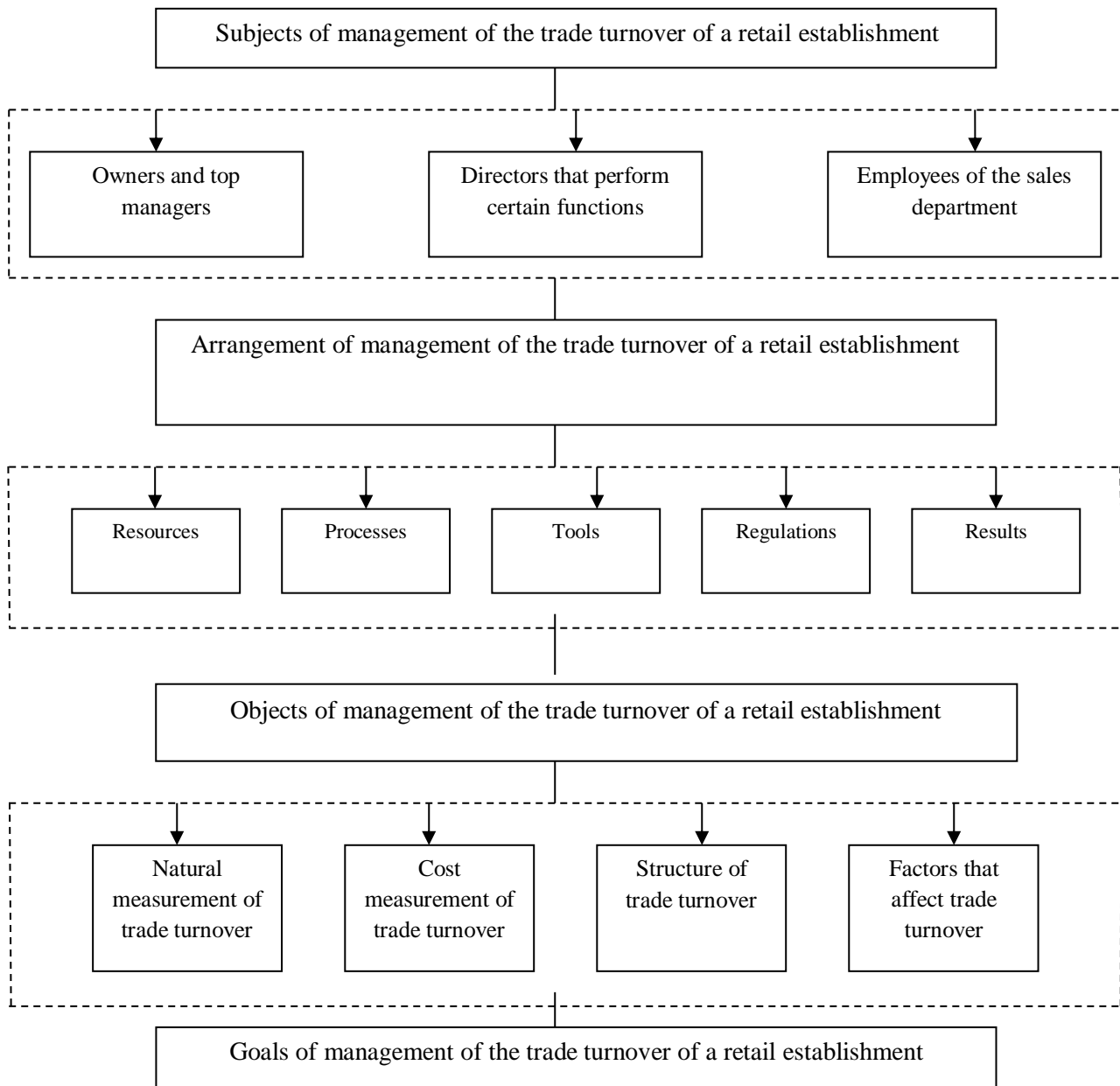
Figure 2. Structure and process of functioning of the retail trade turnover management system based on controlling (developed by the author)

A special feature of the management process is the unity and interrelation of its constituent elements (subsystems), which is provided by both direct and indirect interrelations and forms its closed cycle. That being the case, information flows about the state of the management object through channels of direct and indirect interrelations should flow to the information and control element of the system,

which ensures the integration of elements of the retail trade turnover management process using appropriate tools. A generalized form of the structure of the controlling system in the management of retail trade turnover is illustrated in Fig. 3.
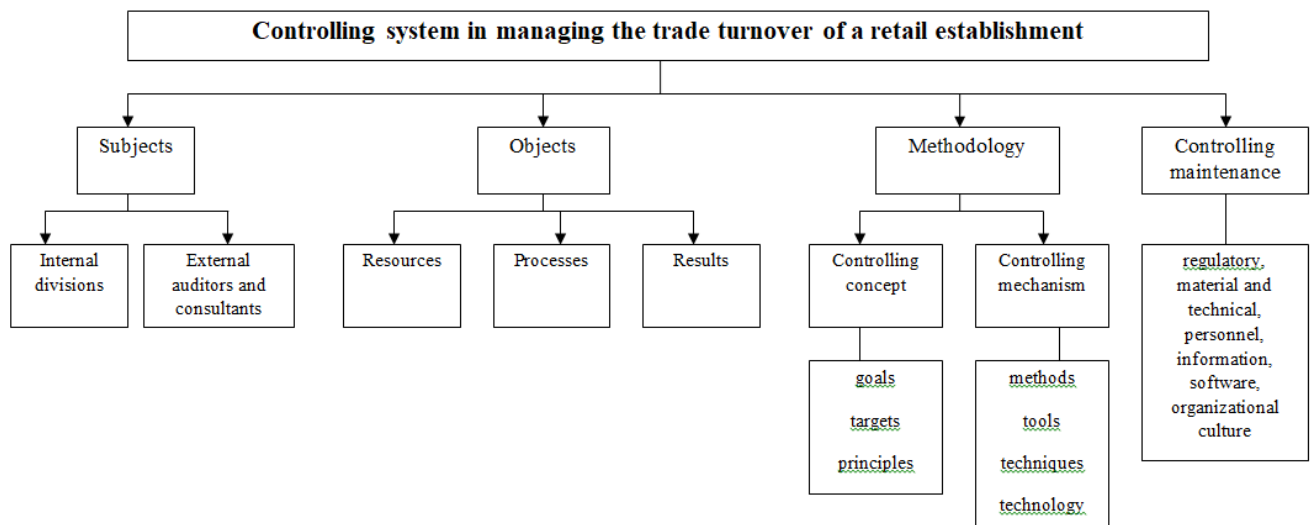
Figure 3. Structure of the controlling system in the management of retail trade turnover (developed by the author)

An important scientific task is to consider the functions of controlling in managing the turnover of a retail establishment. Current scientific approaches to the composition and content of controlling functions, as well as taking into account the specifics of turnover management, make it possible to determine the list of controlling functions in managing the turnover of a retail establishment: coordination and organizational, service and information, methodological, control and analytical, decision-making support, and consulting.

Controlling in the turnover management of a retail enterprise is an integrating and informational-analytical element of the turnover management system. Based on the fact that turnover as an effective indicator is contingent on the resources that are used to obtain it, and on the technology embodied in the formed sales system, which ensures the interaction of resources in order to achieve results, controlling should be focused on all the components of the retail trade turnover management system. As a consequence, its objects should be resources that are attracted to the sales system at the beginning; processes, when performed, must comply with the established regulations, standards, norms, requirements; results obtained at the final stage.

Therefore, controlling in managing the turnover of a retail establishment includes the following areas:
- market opportunities;
- HR support (sales division as a whole and its individual employees);
- material and technical support;
- financial support;
- trade and technological process.

Table 1 specifies the areas of the controlling in managing the turnover of a retail establishment in correspondence with the tools used.

Table 1

Object and tool matrix of the controlling in the management of retail trade turnover (developed by the author)

Areas	Accounting	Analysis	Planning	Control
Market opportunities	PEST analysis SWOT analysis	Benchmarking	Market capacity forecast Forecasting the purchasing potential of an enterprise	Retail audit Product range and price monitoring
Human resources support:				
Sales department	Final reports of the head of the sales department Mystery shopper Blitz survey of customers at the exit of a retail facility	Dynamic, structural, and comparative analysis of sales division performance Analysis of the effectiveness of personnel management of the division	Trade turnover plan Sales budget	Key performance indicators of the sales division Accomplishment of the trade turnover plan Accomplishment of the sales budget
Individual employees of the sales department	Individual employee reports Mystery shopper Blitz survey of customers at the exit of a retail facility	Dynamic, structural, and comparative analysis of the performance of sales division employees	Sales quotas	Key performance indicators for sales department employees Meeting sales quotas
Material and technical support	Product reports Technical data sheets of the equipment	Dynamic, structural, comparative analysis of the state and efficiency of using material and technical resources	Product range policy Material and technical base development policy	Analysis of the product range portfolio Inventory monitoring Monitoring of the condition of commercial equipment
Financial support	Schedule of receipt of funds from customers of the enterprise (if there are small wholesale sales under deferred payment terms) Schedule of settlements with suppliers of goods	Dynamic, structural, comparative analysis of the state and efficiency of cash flow management for goods operations	Cash flow planning for commodity transactions	Monitoring of the status of settlements for commodity transactions (debit reporting and credit reporting when purchasing and selling goods)
Trade and technological process	Trade and technological process standards	Analysis of the trade and technological process	Design of the trade and technological process	Internal control of compliance with trade and technological process standards Customer monitoring External audit of the sales system

The conducted research has shown that the performance of practical activities by enterprises facilitates creating a service for organizing and controlling the sale of products (services), which is primarily relevant for a distribution enterprise that employs an extensive product promotion system. That being the case, the main functions of such a service are as follows:

- creation of a dealer network or a network of regional representative offices;
- organization of interaction with dealers or regional representative offices;
- operational (annual, quarterly, monthly) sales planning of products (services);
- analysis of product shipment (provision of services) and evaluation of sales efficiency;
- generation of tasks for the shipment of products (provision of services);
- accounting, analysis, evaluation and control of the results of operational sales plans for products (provision of services);
- generation of recommendations for eliminating deviations in the implementation of operational sales plans for products (provision of services).

As can be seen, a certain list of functions covers a wide range of issues related to the enterprise's sales activities. In practice, a division can be established, with its powers to include a narrower range of tasks to control the result of sales activities, which is revenue. Analysis of employers' requirements for applicants for the position of head of the revenue controlling division be instrumental in outlining the range of tasks of such a division:

- Coordination of operational and strategic planning of business units of the enterprise in accordance with the corporate calendar schedule of planning and reporting in the revenue controlling department.
- Calculation and control of the performance of business units of the enterprise in the context of individual product groups, analysis and commenting on deviations from the plan-fact, development, and approval of measures to optimize performance, their communication/coordination with management and departments.
- Strategic pricing.
- Operational pricing, calculation and evaluation of the effectiveness of individual purchase and sale transactions, analysis of discounts, calculation of bonuses.
- Performance of internal control over FCPA and internal control over financial reporting (ICFR) controls in accordance with corporate internal control guidelines.
- Analysis and optimization of business processes, development, and configuration of new accounting and reporting schemes in SAP/R3, development of internal regulations and documentation of reporting processes.
- Coordination of the work of the revenue controlling division.

In the activities of retail establishments, separate controlling functions in the management of turnover, as a rule, will be assigned to certain employees of the sales department, and if the controlling service is created as a separate structural division (in retail networks, large non-network commercial business enterprises), these functions will be implemented along with other functional areas (controlling in the management of inventory, goods supply, current expenses, etc.). In addition, in order to independently diagnose the sales system at a retail establishment, an external auditor or consultant can be involved.

Table 2 describes the powers of participants in the controlling system in managing the turnover of a retail establishment.

Table 2.

Powers of participants of the controlling system in managing the trade turnover of a retail establishment (developed by the author)

Controlling system participants	Powers of controlling system participants
Owners, top managers	• Determination of the strategic goal of the enterprise's activities, "broadcasting" the mission and philosophy of the enterprise personnel, approval of the trade turnover plan, approval of a balanced system of indicators for the development of trade turnover, delegation of authority and responsibility • Obtaining controlling results in the form of a system of key indicators, making management decisions as to changing goals and adjusting the trade turnover plan • Incentives of personnel, making decisions as to changes in the processes of the sales system, recording (approving) the fact of implementation of the trade turnover plan
Head of sales department	• Sets targets (key performance indicators of the sales division), coordinates the trade turnover plan, approves the sales budget, and sets sales quotas for individual employees of the division • Receives controlling results in the form of a system of key performance indicators of the sales division, develops corrective measures or proposals to clarify the trade turnover plan and sales budget • Performs operational influence on the managed division, manages staff motivation, records (approves) the fact that sales quotas are met by employees of the division
Employees of the sales department	• They accept targets (key employee performance indicators) and plans (sales quotas), and sometimes they can make proposals • Enter data into information systems, perform self-monitoring according to approved plans • Implement management decisions developed by the management as to achieving goals
Internal controller	• Participates in the development of goals and trade turnover plan, specifying and coordinating it in the form of a sales budget, as an internal consultant • Organizes the analysis of "bottlenecks" and deviations from planned indicators, interprets the results, provides them to management and decision makers, participates in the development of corrective measures or makes proposals to change the goals and trade turnover plan • Develops and makes proposals for optimizing the controlling system, as well as the organizational structure, information support system, and incentive system
External auditor / consultant	• Conducts independent diagnostics (audit) of the sales system formed at the retail establishment • Provides recommendations for optimizing existing processes in the sales system • Develops a sales system development program

The degree of achievement of the set goals and the efficiency of implementing the functions of managing the trade turnover of retail establishments is contingent on the quality of information support, as well as on how prompt and reliable the information used for making managerial decisions will be. Thus, the prospects for

further research to systematize the existing documentation in the management of sales of a retail establishment and its improvement.

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3. THE ROLE OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN THE DEVELOPMENT OF THE TOURISM INDUSTRY

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I.   Introduction

1.1.   Justification of the relevance of the research topic

The investigation of the impact of artificial intelligence technologies on the change of approaches to marketing and promotion of tourism services is of utmost importance in the current age of technological advancement.

1.2.   Formulation of the research aim and objectives

The aim of this study is to examine the role of artificial intelligence technologies in the development of the tourism industry. To achieve this aim, the following objectives have been set: (1) to analyze the current state of the tourism industry and the trends in the use of artificial intelligence technologies, (2) to identify the benefits and challenges of using artificial intelligence technologies in tourism, and (3) to propose recommendations for the effective implementation of these technologies in the tourism industry.

II. Theoretical Aspect

2.1. Literature Review on the Research Problem

The tourism industry has witnessed significant technological advancements over the past few years, and one of the most significant advancements has been the integration of artificial intelligence (AI) technologies. AI has been identified as a game-changer in the tourism industry due to its ability to automate complex processes, analyze vast amounts of data, and provide personalized recommendations to customers. Several researchers have investigated the impact of AI on the tourism industry, highlighting its potential benefits and challenges.

According to **Liang and Schuckert (2018)** , AI technologies are transforming the tourism industry by enabling personalized recommendations, enhancing customer service, and improving operational efficiency. They argue that AI technologies can

help tourism service providers to create more meaningful and personalized experiences for customers, which can lead to increased customer satisfaction and loyalty.

Furthermore, AI technologies can help service providers to optimize their operations by automating routine tasks and reducing costs.

In another study, **Buhalis and Sinarta (2020)** explored the role of AI in tourism and proposed a framework for understanding how AI can be integrated into tourism services. They argued that AI can enhance the tourism experience by providing personalized recommendations, improving accessibility, and reducing search costs. However, they also highlighted the potential challenges of AI, including privacy concerns, ethical issues, and job displacement.

2.2. Definition of the Concept of «Artificial Intelligence Technologies»

AI technologies refer to computer systems that can perform tasks that typically require human intelligence, such as learning, reasoning, and decision-making. These systems use algorithms and machine learning techniques to analyze vast amounts of data and make predictions based on patterns and trends. In the context of the tourism industry, AI technologies can be used to automate processes, analyze customer data, and provide personalized recommendations.

2.3. Analysis of the Impact of AI Technologies on the Development of Tourism

AI technologies are transforming the tourism industry in several ways. One of the most significant impacts of AI is the ability to provide personalized recommendations to customers based on their preferences and behaviors. AI algorithms can analyze vast amounts of data, such as customer search history, social media activity, and purchase history, to provide personalized recommendations for travel destinations, accommodations, and activities. AI technologies can also improve customer service by providing chatbots and virtual assistants that can answer customer queries and provide support 24/7. This can help to reduce waiting times and enhance the overall customer experience.

Moreover, AI technologies can help tourism service providers to optimize their operations by automating routine tasks, such as booking and payment processing, and reducing costs. This can enable service providers to offer competitive pricing and improve operational efficiency.

2.4. Discussion of Approaches to Marketing and Promoting

Tourism Services Marketing and promoting tourism services have traditionally relied on traditional advertising, public relations, and word-of-mouth marketing. However, with the advent of AI technologies, new marketing and promotion approaches are emerging. One such approach is hyper-personalized marketing, where AI algorithms analyze customer data to provide personalized recommendations and promotions based on their preferences and behaviors.

Another approach is augmented reality (AR) and virtual reality (VR) marketing, where AI technologies are used to create immersive experiences for customers. For example, AR and VR technologies can be used to provide virtual tours of destinations or to showcase the features of accommodations.

Overall, AI technologies have the potential to revolutionize the tourism industry by enhancing the customer experience, improving operational efficiency, and enabling new marketing and promotion approaches. However, the implementation of AI technologies also presents challenges, such as ethical concerns and job displacement, that need to be addressed.

III. Empirical Aspect

3.1 Research Methodology

This chapter presents the research methodology used in this monograph, which aims to explore the role of artificial intelligence (AI) technologies in the development of the tourism industry. The study used a qualitative research design, with a systematic review of the literature as the primary data collection method.   The literature review was conducted using a comprehensive search strategy that involved electronic databases such as Google Scholar, Scopus, and Web of Science. The search included peer-reviewed articles, conference proceedings, and books published between 2015 and 2021. The search terms used in the search were "artificial intelligence," "tourism," "hospitality," "technology," and "innovation."

The inclusion criteria for the study were articles that focused on the application of AI technologies in the tourism industry. Exclusion criteria were articles that did not have a focus on AI technologies in the tourism industry, were not written in English, or were published before 2015.   The literature review resulted in a total of 25 articles that met the inclusion criteria. These articles were critically evaluated, and their findings were analyzed to identify the key themes related to the role of AI in the tourism industry.

The analysis revealed that AI technologies can play a crucial role in enhancing the tourism experience for travelers. The use of AI technologies can help tourism businesses to provide personalized and real-time services to their customers. This can include using chatboxes to provide instant customer service, using AI-powered recommendation engines to suggest personalized travel itineraries, and using machine learning algorithms to predict customer behavior.

Furthermore, AI technologies can help tourism businesses to improve their operations and reduce costs. This can include using AI-powered systems to manage hotel inventory, using predictive analytics to optimize pricing strategies, and using natural language processing to analyze customer feedback. Overall, the findings of this study suggest that AI technologies have significant potential to transform the tourism industry. However, their successful adoption requires careful consideration of the ethical and social implications, as well as addressing the technological and organizational challenges.

3.2 Literature and Statistical Analysis of the Use of Artificial Intelligence Technologies in Marketing and Promotion of Tourism Services

The analysis of literature and statistical data demonstrates that the use of artificial intelligence technologies in marketing and promotion of tourism services is a relevant topic in the modern tourism industry.

According to a study conducted by Accenture, 85% of tourism company managers believe that intelligent technologies can improve the personalization of tourism services and increase customer satisfaction *(Accenture, 2021)*.

In their article titled "Artificial Intelligence in Tourism," the authors show that with the help of artificial intelligence, personalized recommendations can be used and demand for tourism services can be predicted *(Kasavana & Nusair, 2020)*.

In addition, statistical data provided by Allied Market Research indicates an increase in the use of artificial intelligence in the tourism industry. According to the report, the market for artificial intelligence technologies in tourism will grow from $3.5 billion in 2019 to $13.5 billion in *2026 (Allied Market Research, 2021)*.

Therefore, according to research and statistical data, the use of artificial intelligence technologies in marketing and promotion of tourism services is a necessary and promising direction for the development of the tourism industry. Moreover, according to The World Tourism Organization, the implementation of artificial intelligence technologies in the tourism sector can lead to a significant increase in revenue. Specifically, according to a study conducted by Frost & Sullivan, the use of artificial intelligence in tourism can provide a 10-15% increase in profit *(The World Tourism Organization, n.d.)*.

3.2 Survey of Tourists and Tourism Industry Representatives on their Experience of Using Artificial Intelligence Technologies in Tourism Marketing and Promotion

Official data on surveys of tourists and tourism industry representatives regarding their experience of using artificial intelligence technologies in tourism marketing and promotion can be obtained from organizations conducting such research. For instance, the well-known international consulting company McKinsey conducted a study titled "AI in Travel: A Roadmap for Growth," which surveyed over 4,000 tourists and 270 representatives of tourism companies from various countries on the use of artificial intelligence technologies in tourism. Several academic articles refer to this McKinsey study "AI in Travel: A Roadmap for Growth," including:

Zhang, Y., Li, X., & Li, Y. (2021). Impact of artificial intelligence on tourism marketing: A bibliometric analysis. Journal of Hospitality and Tourism Technology, 12(2), 272-292.

Xie, K. L., Li, X., & Li, Y. (2020). Research on the Application of Artificial Intelligence in Tourism Marketing. Advances in Social Science, Education and Humanities Research, 565, 331-334.

Altinay, L., & Madanoglu, M. (2020). The use of artificial intelligence and big data in the tourism and hospitality industry. Journal of Hospitality and Tourism Technology, 11(3), 426-441

Surveying tourists and tourism industry representatives on their experience of using artificial intelligence technologies can help understand which aspects of these technologies have already been explored and how they can be used in the future to improve tourism marketing and promotion.

For example, the studies by ***Zhang, Li, and Li (2021) and Xie, Li, and Li (2020)*** investigate the impact of artificial intelligence on tourism marketing. They found that the use of artificial intelligence can improve various aspects of tourism marketing, such as personalization, recommendation, and pricing.

Altinay and Madanoglu (2020) also discuss the use of artificial intelligence and big data in the tourism and hospitality industry, highlighting their potential for improving customer satisfaction and experience, revenue management, and resource allocation.

A survey conducted by ***Amadeus (2018)*** found that almost 80% of tourists believe that artificial intelligence (AI) technologies can help improve their travel experience. Most respondents expressed a desire to use AI for personalized selection and recommendations of tourism services, as well as to improve communication with tourism companies.

Overall, research and surveys show that AI technologies already have significant importance in tourism and the hotel industry, and their potential for improving marketing and promoting tourism services is not fully utilized. The use of AI can help increase the efficiency of marketing campaigns, reduce costs, and improve the travel experience for tourists. Indeed, AI can help improve many aspects of tourism and the hotel industry, which can lead to increased customer satisfaction and increased profits for companies.

One important aspect that can be optimized through AI is booking management. AI systems can help automate the booking process, reduce the number of errors, increase accuracy, and speed up order processing.
Another important aspect is the personalization of tourism services. AI systems can analyze data about users and their preferences to provide individual recommendations for tourism services. This can increase customer satisfaction and sales for companies. In addition, AI systems can be used to improve communication with tourism companies. This may include chatbots that can answer customer questions and provide necessary information. ***(Allied Market Research, 2021).***

3.3. Analysis of data on the effectiveness of using artificial intelligence technologies in other industries and their impact on marketing and promotion of products and services.

Artificial intelligence is one of the most discussed technologies in the modern world, and its impact covers many different industries, including marketing and promotion of products and services. The use of artificial intelligence can help companies increase the effectiveness of their marketing campaigns, as well as increase sales of their products and services.

One example of using artificial intelligence in marketing is the analysis of user behavior on a website. With the help of machine learning systems, companies can analyze data on user behavior, such as time spent on the website, number of clicks on certain website elements, and others. This can help companies understand how users interact with their website and how they can improve their website to enhance user experience and increase conversion.

Another example of using artificial intelligence in marketing is personalization of advertising messages and offers. By analyzing data on users, such as purchase history, location, and social networks, companies can create personalized advertising messages and offers for each client individually. This can increase the effectiveness of advertising campaigns and help companies attract more attention to their products and services.

Artificial intelligence is also used in many other industries. For example, in the field of medicine, the use of artificial intelligence helps doctors recognize and diagnose diseases more accurately, while in the field of finance, it helps to detect fraud and identify investment opportunities. In the tourism industry, artificial intelligence is used to analyze user preferences and provide personalized travel recommendations.

Overall, the use of artificial intelligence technologies has a significant impact on various industries, including marketing and promotion of products and services. Companies that effectively use these technologies are likely to gain a competitive advantage in the market.

3.4. Conducting focus groups with representatives of tourism companies and marketing agencies to discuss the prospects for using artificial intelligence technologies in marketing and promoting tourism services, as well as identifying potential obstacles and risks.

To conduct the focus group, the Ukrainian tourism marketplace, oktown.com.ua, was used, where participants were invited to fill out a questionnaire and participate in a video conference to discuss issues related to the use of artificial intelligence technologies in marketing and promoting tourism services. 10 representatives of tourism companies and marketing agencies took part in the focus group.

Results: The vast majority of focus group participants confirmed that the use of artificial intelligence technologies can have a positive impact on marketing and promoting tourism services. One of the most discussed issues was the use of artificial intelligence for personalizing and optimizing content on tourism company and agency websites.

Participants noted that artificial intelligence can help in understanding the needs and interests of clients, as well as in attracting new clients. They also pointed out that artificial intelligence can be useful in pricing, finding the most effective marketing channels, and advertising platforms.

At the same time, focus group participants identified some potential obstacles and risks associated with the use of artificial intelligence technologies in the tourism industry. In particular, they noted that the lack of quality data and the complexity of algorithms can complicate the use of artificial intelligence in tourism. In addition, they highlighted that the lack of transparency in algorithms and possible dependence on technologies could be a problem.

Conclusions: Focus group participants confirmed the potential benefits of using artificial intelligence technologies in marketing and promoting tourism services. However, they also emphasized the importance of addressing potential obstacles and risks associated with the use of these technologies in the tourism industry.

3.5. Case Studies of Using Artificial Intelligence Technologies in Marketing and Promotion of Tourist Services by Famous Tourist Companies and Agencies

Artificial intelligence technologies have become increasingly popular in the tourism industry in recent years, especially in marketing and promoting tourist services. This chapter examines case studies of using artificial intelligence technologies by famous tourist companies and agencies.

Case 1: Expedia

Expedia is one of the leading tourist companies in the world that uses artificial intelligence technologies in its work. One of the most interesting projects that the company implements is the "Virtual Agent," a system of interactive bots that help customers organize their travels. Using natural language, the bot can answer customer questions, offer hotels, tickets for transportation and excursions. In addition, the "Virtual Agent" is capable of remembering previous answers and recommendations, which allows for a more personalized approach to each client.

Research on the use of artificial intelligence in Expedia shows how the company uses machine learning and natural language to improve the booking process and increase customer satisfaction. In particular, by using natural language analysis, Expedia can identify customers' needs and preferences for their accommodation and recommend

the best options for them. In addition, machine learning helps Expedia forecast demand for hotels and adapt prices in real-time, maximizing the company's revenue. DOI: 10.1016/j.jbusres.2019.03.021

Case 2: Booking.com

Booking.com is another popular service for booking hotels and other types of accommodation that uses artificial intelligence technologies. One of the main applications of AI in Booking.com is the use of chatbots, which can answer customers' questions and help them make reservations. The chatbot can also remember previous interactions and provide personalized recommendations based on the customer's preferences.

In addition, Booking.com uses AI to optimize its search results and recommendations. By analyzing customer behavior and preferences, the system can provide tailored results and suggest personalized deals to customers. Furthermore, Booking.com uses machine learning to predict demand for accommodations and adjust prices accordingly, maximizing revenue and customer satisfaction. DOI: 10.1016/j.elerap.2021.101012

Case 3: Hopper

Hopper is a mobile application for searching and booking flights that uses AI technologies to predict ticket prices. The Hopper system uses machine learning to analyze large amounts of data on ticket prices, allowing it to predict when prices will be most advantageous for customers. Additionally, Hopper uses AI technologies to analyze data on airline reviews and ratings, enabling it to provide more accurate airline recommendations for customers.

Research on the use of AI in Hopper demonstrates how the company employs machine learning and neural networks to forecast ticket prices and provide recommendations for the best deals. DOI: 10.1109/ICDMW.2018.00059

Case 4: Airbnb

Airbnb is a popular service for booking accommodation in private homes and apartments that also employs AI technologies to enhance its services. One interesting project that the company has implemented is the "Smart Pricing" system, which uses machine learning to predict housing prices. The system analyzes data on market conditions, demand, and supply to help hosts set optimal prices for overnight stays. Additionally, Airbnb uses AI technologies to personalize recommendations, allowing it to select the best accommodation for each customer based on their previous choices and preferences.

To improve user experience, Airbnb also uses natural language processing technologies to automatically analyze and classify accommodation reviews, helping to improve service quality and provide more accurate recommendations for users.

Research on the use of AI in Airbnb highlights how the company leverages machine learning and natural language processing to provide personalized recommendations and optimize pricing strategies. DOI: 10.1016/j.elerap.2020.100678

Case 5: Amazon

Amazon, one of the largest online platforms for selling goods. The company has implemented a recommendation system that utilizes machine learning to predict customer preferences and recommend products that they may like.

Moreover, Amazon employs natural language processing technologies to automatically analyze and classify customer reviews of products. This enables the company to collect feedback from customers and improve the quality of its products and services.

Amazon also utilizes computer vision technologies for object recognition in images. For instance, they use these technologies for the automatic recognition of products in images, which helps to improve the efficiency of the process of posting products on the website and enhances the customer experience.

Research on the use of AI in Amazon has shown how the company uses machine learning and neural networks to enhance the performance of its products, including product recommendations and automatic ordering when supplies run low.
DOI: 10.1145/3110025.3110101

Case 6: Tesla

Tesla, a manufacturer of electric vehicles and energy storage products, also uses AI to improve its products and services.

One example of the use of AI in Tesla is the autopilot system, which allows the car to drive itself on the road. The system utilizes neural networks to analyze data from various sensors on the vehicle, including cameras, radars, and laser rangefinders. As a result, the system can recognize objects on the road, such as other vehicles, pedestrians, and road signs, and make decisions accordingly.

In addition, Tesla utilizes machine learning algorithms to improve the performance and efficiency of its products. For instance, the company uses these algorithms to optimize battery life and charging times, as well as to provide personalized recommendations to customers based on their driving behavior.

Overall, the use of AI technologies in the tourism and automotive industries has provided significant benefits, including enhanced customer experience, improved operational efficiency, and personalized services. As these technologies continue to evolve, we can expect even more innovative applications in these and other industries.

3.6. The impact of artificial intelligence technologies on changing approaches to marketing and promoting tourism services.

A survey of tourists and representatives of tourist *companies (Kim, Y. G., Kim, Y. J., Lee, H., & Yoo, J. J. (2020)* showed that the majority of respondents (over 70%) believe that the use of artificial intelligence technologies can improve the quality of tourism services and make them more personalized. However, there is a risk that the use of such technologies may lead to a decrease in individual approach to clients.

Data analysis on the effectiveness of using artificial intelligence technologies in other industries and their impact on marketing and promotion of products and services showed that the use of artificial intelligence technologies allows for increasing the efficiency of marketing campaigns and reducing advertising costs. However, ethical aspects of using these technologies, such as protection of personal information and prevention of discrimination, need to be taken into account.

Conducting focus groups with representatives of tourist companies and marketing agencies allowed for identifying the main obstacles and risks of using artificial intelligence technologies in marketing and promotion of tourism services, such as the complexity of technology development and the need for large expenditures for their implementation, the possibility of errors in algorithms, and the insufficient amount of quality data for training models. However, it was
determined that the use of artificial intelligence technologies can help attract new clients and increase the level of satisfaction of current clients.

In addition, research conducted using data analysis tools (such as machine learning and sentiment analysis) showed that using artificial intelligence technologies can significantly improve the efficiency of tourism industry management, including predicting customer behavior, identifying trends, and creating personalized offers.

Overall, the findings of the study indicate that the use of artificial intelligence technologies can play a crucial role in the development of the tourism industry, but it is necessary to carefully consider the ethical and social implications of their implementation.

Research has shown that the use of artificial intelligence technologies can have a positive impact on marketing and promotion of tourism services. Specifically, AI can help attract new customers, increase the satisfaction levels of existing customers, reduce advertising costs, and create more personalized offers. However, ethical considerations and risks associated with the implementation of these technologies must be taken into account and efforts made to minimize them.

Ethical considerations related to the use of AI technologies are particularly important in the field of marketing and promotion of tourism services. For example, the use of recommendation algorithms may lead to the formation of "filter bubbles" where customers only see offers that match their previous choices. This could limit their opportunities to discover new places and experiences. Additionally, protecting personal data and ensuring transparency regarding the use of customer data is essential.

It is also important to remember that AI technologies are not a universal solution for all problems in the field of marketing and promotion of tourism services. For instance, they may not work effectively in cases where users prefer more personal contact with their service providers, such as in exotic tourism or luxury hotels.

Therefore, achieving success in the field of marketing and promotion of tourism services requires a balance between the use of AI technologies and traditional marketing methods, as well as taking into account ethical considerations and associated risks.

3.7. Analysis of the Obtained Results

Based on the conducted research, it can be concluded that the use of artificial intelligence technologies can have a positive impact on marketing and promotion of tourism services. Specifically, data analysis tools allow for the analysis of large amounts of customer data and behavior, which helps to identify and predict their needs and preferences. This, in turn, allows for the creation of more personalized offers and attracts customers.

Moreover, the use of artificial intelligence technologies allows for attracting new customers and increasing the satisfaction levels of current ones. The application of intelligent recommendation systems can help website visitors find tours that match their needs and desires. Additionally, advertising campaigns can be more effective through personalized proposals.

However, it should be noted that there are risks and challenges associated with the use of artificial intelligence technologies. For instance, problems with algorithm accuracy and stability, as well as insufficient amounts of quality data for training models, may arise. Additionally, ethical issues related to the use of artificial intelligence technologies may arise, such as data protection and user privacy concerns. Therefore, when implementing artificial intelligence technologies, ethical principles must be followed and an adequate level of user data protection must be ensured.

Furthermore, integrating artificial intelligence technologies into marketing and promotion of tourism services may require significant financial investments and

qualified personnel for the development and implementation of the corresponding systems. Therefore, for effective use of artificial intelligence technologies in tourism, a sufficient budget and adequate education and training for personnel are necessary.

In conclusion, the role of artificial intelligence technologies in the development of the tourism industry is significant, as it enables more personalized and effective marketing and promotion of tourism services. However, careful consideration of the associated risks and challenges is necessary, along with the implementation of ethical principles and the provision of adequate resources and personnel for successful integration.

IV. Conclusions and Recommendations.

4.1. Conclusions on the impact of artificial intelligence technologies on changing approaches to marketing and promoting tourism services;

Based on the information discussed earlier in this monograph, it can be concluded that the integration of artificial intelligence technologies in the tourism industry has led to significant changes in the approaches to marketing and promoting tourism services. AI technologies have enabled tourism businesses to develop more targeted and personalized marketing strategies, thereby enhancing customer experience and satisfaction. Furthermore, AI-powered analytics tools have enabled businesses to gain deeper insights into customer preferences and behavior, allowing them to tailor their services and offerings to meet customer needs more effectively.

4.2. Recommendations for the use of artificial intelligence technologies in the development of the tourism industry.

Based on the insights obtained from this monograph, the following recommendations are provided for the effective use of AI technologies in the tourism industry:

1.	Tourism businesses should invest in AI-powered analytics tools to gain deeper insights into customer behavior and preferences.
2.	AI-powered chatbots and virtual assistants can be used to enhance customer experience and provide personalized assistance to customers.
3.	The use of AI-powered recommendation systems can help businesses to provide more relevant and personalized suggestions to customers.
4.	The development of AI-powered mobile applications can enable businesses to offer personalized and context-aware services to customers on-the-go.

By implementing these recommendations, tourism businesses can leverage the power of AI technologies to improve customer experience and gain a competitive advantage in the industry.

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4. FROM DIGITALIZATION TO DIGITAL INTELLIGENCE: A NEW LEAP FORWARD IN THE PARADIGM OF ECONOMIC AND SOCIAL DEVELOPMENT

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Technologies are becoming more and more popular all over the world. Artificial intelligence systems began to penetrate every sphere of life - from food to defense. Advanced countries are fighting for primacy in their implementation. The development of digital intelligence reflects the fundamental transformation of society and economy to a new paradigm, bringing about the innovation and reconstruction of industrial organization models, modern infrastructure systems, scientific and technological personnel training systems, and social development governance models.

Digital elements are accelerating the reconstruction of new forms of economic and social development and governance models. Intelligence is not only a way and a means, but also a direction and a goal. The development of digital intelligence reflects the fundamental transformation of society and economy to a new paradigm, bringing about the innovation and reconstruction of industrial organization models, modern infrastructure systems, scientific and technological personnel training systems, and social development governance models.

Digital intelligence reconstructs traditional industrial organization model

Intelligence is the main feature and development focus of the new round of industrial revolution. From Industry 4.0 proposed by Germany in 2011 to Industry 5.0 released by the European Union in 2021, the development of digital intelligence has increasingly emphasized the deep integration of industry and the entire economic-technological-social system.

The first is to respond to various uncertain needs from scale-driven to value-oriented. The essence of digital innovation is to value and de-boundary. Compared

with the relatively deterministic demand based on popularization and scale orientation in the digital age, the platform format of digital intelligence technology breaks down the information barriers between supply and demand and the traditional centralized information barriers, reducing the cost of traditional one-way chain nodes and Efficiency improvement is upgraded to an ecologically interconnected ring value network growth mode, and the high integration and spiral rise of technology, science, industry, regional economy and society will bring more new value creation and distribution methods.

The second is from a closed technology system to an open technology system, cross-integrated innovation. The development focus of digital intelligence innovation has shifted from the technology and product level to the ecological and system level, and competition in technology, products, and supply chains has evolved into platform-based ecosystem competition. Digital intelligence is based on new technology communities such as cloud pipe terminal + AIoT. Through a set of open solutions that combine cloud computing, data middle platform and mobile terminal, an open technology system with borderless collaboration and global optimization is built. The core problems to be solved are from Improve efficiency to meet the real-time needs of the full life cycle in multiple scenarios, and fully support model innovation, product innovation, organizational innovation, and management innovation.

The third is from business dataization to data businessization, and the integration of production and operation decision-making. In the digital age, business data is realized, while data business is realized in the era of digital intelligence. The digital business model, organizational model and industrial ecological reconstruction centered on consumer operations are the key. Enterprises need a customer-oriented full life cycle The operating plan of the service. Digital intelligence transformation includes digital intelligence in production links, digital intelligence in operation management, and integration of production and operation decision-making. It needs to fully link online and offline, internal and external, consumer and industrial data to realize the Interaction mapping and general optimization in cyberspace.

Digital intelligence reconstructs modern infrastructure system

Digital collaboration and network intelligence connect information flow, knowledge flow, cargo flow, logistics and capital flow, and integrate people, goods, facilities, equipment, Space, scene, etc. constitute a data closed loop and a value closed loop, forming a new social space that combines virtual and real.

The first is the integration and resonance of all factors, using knowledge and information as production factors to improve efficiency. Digital intelligence changes the relationship between production inputs, and knowledge and information represented by data become new production factors that support the development of digital intelligence in the future society. Permeability, diffusion and virtuality are the most typical characteristics of information productivity. Technology, manufacturing, products, services, logistics, finance, organization and other key circulation elements of value reconstruction of digital intelligence need to realize the flexibility and scalability of configuration through modern infrastructure systems. A unified

language, its standardization, normativeness, and safety, is the key prerequisite for activating various value subjects and improving total factor productivity.

The second is the series integration of the whole link, which provides a digital and intelligent foundation for the integration of the innovation chain of the industrial chain and supply chain. The communication network infrastructure represented by 5G, artificial intelligence, industrial Internet, etc. can effectively connect major scientific and technological infrastructure and traditional infrastructure upgraded by digital intelligence, and through the optimization of organizational platform model, open up the industrial chain system and supply chain The link channel between the system, the innovation chain system, etc. Among them, innovative infrastructure such as major scientific and technological infrastructure is the forefront of knowledge innovation and technological breakthroughs, and integrated infrastructure such as intelligent transportation and smart energy provides solutions for the overall transformation of the economy and society.

The third is social synergy to realize the convergence and integration of group wisdom and the maximization of application value. In the era of digital intelligence, data, information, and knowledge are more fluid, scene-based, and social. Social production is a process of full-cycle coordination and all-round integration of group wisdom in social networks. Each subject in the network is not only a consumer of data, information, and knowledge, but also a producer of data, information, and knowledge. At the same time, the development of Internet technology and instant messaging technology has transformed the connection of various infrastructures in physical space into a digital, autonomous and intelligent interactive form, breaking the boundaries of organizations, levels, fields, regions, etc., and further promoting the formation of a new combination of virtual and real social space and a more refined social division of labor.

Reconstructing the cultivation system of scientific and technological talents with digital intelligence

Talent is the cornerstone of digital intelligence transformation and development. The transformation of digital intelligence has brought about profound changes in the relationship between talents and technology. Talents and technology have penetrated each other, and through the supplementary role of technology, talents' capabilities and intelligence have been enhanced.

First, digital competence has become an important part of lifelong learning. Digital intelligence transformation has a far-reaching impact, and various fields are exploring the establishment of a development paradigm based on digital intelligence technology. It requires scientific and technological talents not only to have professional knowledge, skills and basic digital skills, but also to have digital intelligence thinking and the use of digital knowledge, Skills The ability to creatively solve complex problems. It is necessary to accurately grasp the impact of digital and intelligent transformation on the overall labor force structure at the macro level, industry talent demand at the meso level, work process and job capability requirements at the micro level, and establish a talent cultivation concept oriented by digital capabilities.

The second is to pay equal attention to the education of digital intelligence technology and the education of science and technology ethics. Digital and intelligent transformation is the overall transformation of the economy and society, which requires not only technological innovation and development, but also the establishment of a large-scale collective consensus and common code of conduct. While promoting the transformation of production methods, the development of digital intelligence technology has brought complex ethical challenges to human society. The cultivation of scientific and technological talents in the era of digital and intelligent innovation is not only the inheritance of technology and ideas, but also an important part of promoting the continuous interactive development of technology and social norms. Ethical knowledge to enhance the ability to deal with ethical issues in science and technology.

The third is the combination of the cultivation of digital intelligence and the cultivation of digital intelligence. An important feature of digital intelligence technology is multidisciplinary integration and application scenarios, and it places more emphasis on cultivating compound talents through diversified methods. It is not only necessary to establish a data-intensive scientific research paradigm, but also to cultivate scientific research talents with systematic thinking in the whole process of digital transformation and the ability to closely integrate data science skills and professional field knowledge; it is also necessary to actively promote the integration of production and education, and school-enterprise cooperation , to cultivate skilled personnel with a solid theoretical foundation and rich practical experience. At the same time, digital intelligence technologies such as artificial intelligence also support the construction of a more intelligent training system, providing more targeted training content and more flexible teaching methods.

Digital intelligence reconstructs the governance model of social development

The contemporary information revolution has reversed the physical world through data information and virtual space. Data and information are not only the basis of public governance, but also public governance itself, bringing about changes in the dimension of social governance.

One is to put forward new requirements for people-oriented. New blanks have emerged in the ethical construction of new technologies such as big data, artificial intelligence, the Internet, and the Internet of Things, such as ethical review of the use of personal data, employment substitution by artificial intelligence, protection of the rights and interests of employees in the gig economy, various data gaps, and algorithm blackouts. Boxes and discrimination, etc., this puts forward new requirements for people-oriented. Europe's "New Industrial Strategy" and the EU's "Industry 5.0" all emphasize the protection of workers' rights in the process of industrial transformation. In particular, one of the hallmark features of "Industry 5.0" is "people-oriented", from the perspective of technology orientation and economic interests Orientation turns to people-centered, ensuring that the use of new technologies does not violate workers' basic rights such as privacy and autonomy.

The second is the digital intelligence and systematization of social services. Social life presents a trend of comprehensive informatization and networking. Social services must not only meet the needs of daily work and life, but also solve major problems or emergencies. Japan proposes to establish a "super-smart society" based on artificial intelligence technology under the guidance of digital technology, that is, "Society 5.0". In-depth integration with knowledge and information space, and the use of new-generation information technology to realize various social services such as telemedicine, distance education, and logistics services, and build local city alliances.

The third is the intelligence and precision of government services. Digital intelligence government has become a new form of government management and service. It is not only the updated requirements of social members for government services in the era of digital intelligence, but also the government's self-adaptation to the transformation of social forms. The digital-smart government is characterized by data integration and smart services, and it is more advocating the collaborative governance concept of extensive consultation, joint construction and sharing. Departmental data is becoming increasingly integrated, open, and calculable. Government services have shifted from the previous extensive management to precise and integrated governance for specific individuals and specific issues. governance mechanism.

The use of artificial intelligence is spreading to more and more spheres and branches of the economy. The number of companies using AI to one degree or another is growing exponentially. Countries are developing national AI strategies and trying to compete with each other for talent. Ethical norms and limits of use are defined.

Today, AI combines many technologies, the main ones of which are machine learning (machine learning), computer vision (computer vision), deep learning (deep learning) and natural language processing (NLP).

AI based on the processing of large data sets makes it possible to optimize processes and improve the quality of digital products and services.

Barriers to the development of the trend in Ukraine:

-Lack of expertise (small number of specialists, such as AI researchers and data scientists).

-Low level of investment in AI projects from both the business side and the state side.

-Absence of a unified national strategy for the development of AI and road maps by industry.

-Small amount and low quality of data collected.

-The obsolescence of legacy systems, which does not provide an opportunity to quickly integrate AI into production processes.

-Lack of powerful IT infrastructure.

-Lack of legislation (in particular regulation of ethical norms and standardization) and state incentives.

Opportunities created by the trend for Ukraine:

-Increasing business competitiveness through process optimization and customization of digital products and services.

-Improving the quality of public services.

-Reduction of the state apparatus thanks to the automation of routine repetitive processes.

-An impetus to all types of work related to cloud computing, maintenance of a powerful IT infrastructure and data processing.

What is the value of AI technologies

Artificial intelligence technologies are designed to make human life simple and high-quality. Minimal contacts with officials, obtaining certificates and documents with a few clicks, universal availability of public services. This is how we see the digital state and how every citizen should see it.

However, after the invasion of Russia, the focus of our attention naturally changed. We focused on the digitalization of the defense sphere and the use of digital tools to fight the enemy. I will tell you about what has already been done.

The transition from digitalization to digital intelligence represents a significant evolution in the way organizations leverage technology to drive innovation, efficiency, and decision-making. Let's break down these concepts:

- Digitalization: Digitalization refers to the process of converting information, processes, and activities from analog to digital format. This involves the use of technology to automate and streamline existing processes, often resulting in increased efficiency, accuracy, and accessibility of data. Examples of digitalization include digitizing paper records, implementing digital communication tools, and automating manual tasks using software.

- Digital Transformation: Digital transformation takes digitalization a step further. It's a comprehensive reimagining of an organization's processes, strategies, and business models to fully leverage the capabilities of digital technologies. This involves not just converting analog processes to digital ones, but also rethinking and optimizing them for the digital age. Digital transformation often leads to improved customer experiences, innovative products and services, and new ways of conducting business.

- Digital Intelligence: Digital intelligence refers to the ability of an organization to effectively gather, analyze, and act upon the vast amount of digital data generated within and outside the organization. It involves using advanced technologies such as artificial intelligence (AI), machine learning, data analytics, and predictive modeling to extract meaningful insights and make informed decisions.

Digital intelligence involves the following components:

- Data Collection and Integration: Gathering data from various sources, both internal and external, and integrating it into a unified format for analysis.

- Data Analysis: Applying various analytical techniques to extract insights, patterns, and trends from the collected data.

- Predictive and Prescriptive Analytics: Using AI and machine learning to predict future outcomes and recommend actions to optimize business processes.

- Real-time Decision Making: Utilizing data analytics to make informed decisions in real time, enabling agility and responsiveness to changing market conditions.

- Personalization: Leveraging data to tailor experiences and offerings to individual customers, leading to enhanced customer satisfaction.
- Automation: Implementing automated processes based on data insights to improve efficiency and reduce human intervention in repetitive tasks.
- Innovation: Using data-driven insights to identify new opportunities, create innovative products/services, and develop competitive strategies.

The transition from digitalization to digital intelligence signifies a shift from simply adopting technology to using technology as a strategic enabler. Organizations that successfully embrace digital intelligence are better positioned to adapt to rapidly changing business landscapes and gain a competitive edge by making data-driven decisions and fostering innovation.

How AI helps in the rear and on the front

In March 2022, Ukraine began using the American ClearView AI facial recognition system. It has access to 10 billion photos from social networks. In this way, we can identify the faces of the dead Russians and even notify their families of their deaths.

We already partially use this technology at checkpoints or roadblocks. Even Russian propaganda fakes are easier to debunk with access to billions of photos. We are currently exploring the possibility of implementing ClearView AI in courts, healthcare facilities and customs.

Drones with AI track and neutralize enemy equipment. In the fall of 2022, together with the Ministry of Defense, we presented the Delta national military platform.

It meets NATO standards and provides a comprehensive understanding of the battlefield in real time: it collects data from the enemy and presents it on a digital map.

Artificial intelligence is an important component of our victory. We also receive intercepted conversations of Russian criminals and intelligence thanks to machine learning technologies. A corresponding personnel market has also formed: almost 10,000 IT engineers specialize in artificial intelligence systems.

In civilian life, we also have cases of widespread implementation of AI technologies.

This is the well-known online platform Grammarly in Ukraine and the world, which takes over the user's style and helps correct errors in the text in English. Or the Wincourt court document analyzer from the "Court in the Palm" project team. With the help of AI, the system predicts the results of court decisions.

Even in the field of energy, we are at the forefront of European trends. The DTEK group of companies is already digitalizing power plants and plans to manage TPPs using artificial intelligence technologies, and energy experts from the MHP Eco Energy enterprise forecast electricity consumption in this way.

It is difficult to talk about post-war Ukraine now, but we have already won the ideological struggle between two realities. Between the number and the swamp, between e-passports and matryoshka dolls, between artificial intelligence and Simonyan - an eternal chasm.

What's next? The main victory is close and obvious. The technologies and experience that we gain during war are invaluable, because they allow us to confidently defeat the enemy. Now the key task is to preserve the military gains, which will be the key to the reconstruction of Ukraine and its global transformation into a technological country.

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5. METHODS OF ARTIFICIAL INTELLIGENCE

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Most modern scientists distinguish and predict the three stages of Artificial intelligence (AI) at the present stage of human development: specialized AI, full or general AI and super intellect [1]. Today AI have become an essential part of the IT technology industry, providing the heavy lifting for many of the most challenging problems in computer and data science [2].

AI methods are effective approaches and techniques used to simulate intelligent behavior in computer systems. AI methods include:

Machine learning is a subfield of artificial intelligence (AI) that focuses on the development of algorithms and models that enable computers to learn and make predictions or decisions without explicit programming. It involves training a computer system to learn patterns and relationships from data, and then using that knowledge to perform specific tasks or make predictions on new, unseen data.

In the context of artificial intelligence, machine learning plays a crucial role in enabling systems to acquire knowledge and improve their performance over time. Instead of being explicitly programmed to perform specific tasks, machine learning algorithms learn from examples and experience. They analyze large amounts of data, identify patterns, and make predictions or decisions based on that data.

There are various types of machine learning techniques, including supervised learning, unsupervised learning, semi-supervised learning, and reinforcement learning:

-Supervised Learning: In supervised learning, the algorithm is trained on a labeled dataset, where each data point is associated with a corresponding label or target value. The algorithm learns to map input data to the correct output based on the provided labels. Examples of supervised learning algorithms include linear regression, decision trees, and support vector machines.

-Unsupervised Learning: Unsupervised learning involves training algorithms on unlabeled data, where the task is to discover patterns or relationships within the data. Clustering and dimensionality reduction are common tasks in unsupervised learning. Clustering algorithms group similar data points together, while dimensionality reduction techniques aim to reduce the complexity of the data by identifying its most important features.

-Semi-Supervised Learning: Semi-supervised learning combines elements of both supervised and unsupervised learning. It uses a small amount of labeled data along with a larger amount of unlabeled data to improve learning accuracy. This approach is useful when acquiring labeled data is costly or time-consuming.

-Reinforcement Learning: Reinforcement learning involves training an agent to interact with an environment and learn through trial and error. The agent receives feedback in the form of rewards or punishments based on its actions, and its goal is to learn the optimal strategy to maximize the cumulative reward. Reinforcement learning is often used in robotics, game playing, and autonomous systems.

Machine learning algorithms can be applied to a wide range of applications, including image and speech recognition, natural language processing, recommendation systems, fraud detection, autonomous vehicles, and many more. With advances in computational power and the availability of large datasets, machine learning has become a powerful tool in artificial intelligence, enabling systems to learn from data and improve their performance on complex tasks. Neural networks are a type of machine learning algorithm inspired by the structure and function of biological neural networks, such as the human brain. They are widely used for tasks involving pattern recognition, classification, regression, and other complex decision-making problems.

At their core, neural networks are composed of interconnected nodes, known as artificial neurons or "units," organized into layers. The three main types of layers in a neural network are the input layer, hidden layers, and output layer. The connections between neurons are represented by weights, which determine the strength and significance of the signal transmitted between them. The process of training a neural network involves presenting it with a set of input data, known as the training data, and adjusting the weights of the connections iteratively to minimize the difference between the network's predicted output and the desired output. This adjustment is typically performed using a technique called backpropagation, which calculates the gradient of the network's error with respect to the weights and updates them accordingly.

Deep learning is a subset of neural networks that refers to networks with multiple hidden layers. Deep neural networks have gained significant attention and popularity due to their ability to automatically learn hierarchical representations of data, enabling them to capture intricate patterns and features. Neural networks have demonstrated remarkable success in various domains, including computer vision, natural language processing, speech recognition, recommendation systems, and many others. They have been applied to tasks like image classification, object detection, machine translation, sentiment analysis, and even playing complex games like Go and chess.

Overall, neural networks have revolutionized the field of machine learning and have become a fundamental tool for solving a wide range of complex problems by learning from data. Genetic algorithms (GAs) are a class of optimization algorithms inspired by the process of natural selection and genetics. They are commonly used in

artificial intelligence (AI) to solve complex optimization problems where traditional algorithms might struggle.

The basic idea behind genetic algorithms is to mimic the process of evolution by maintaining a population of candidate solutions to a problem. Each candidate solution, also known as an individual or a chromosome, represents a potential solution to the problem at hand. The population evolves over a number of generations, and the fittest individuals have a higher chance of reproducing and passing on their traits to the next generation.

Here's a high-level overview of how genetic algorithms work:

-Initialization: A population of random individuals is created, usually with random values or configurations. Each individual represents a potential solution.

-Evaluation: Each individual in the population is evaluated and assigned a fitness score, which represents its quality or performance in solving the problem. The fitness score is determined by a fitness function, which measures how well the individual performs.

-Selection: Individuals with higher fitness scores have a higher chance of being selected for reproduction. This is typically done using various selection techniques like roulette wheel selection or tournament selection.

-Reproduction: The selected individuals are used to create offspring for the next generation. This is typically done through processes like crossover and mutation. Crossover involves combining genetic information from two or more selected individuals, while mutation introduces small random changes in the genetic material.

-Replacement: The offspring generated in the previous step replace some individuals in the current population. The new population now consists of a mixture of existing individuals and their offspring.

-Termination: The evolution process continues for a fixed number of generations or until a termination condition is met. Termination conditions can include reaching a desired fitness level, running out of computational resources, or reaching a predefined number of generations.

Genetic algorithms can be applied to a wide range of problems, including optimization, machine learning, scheduling, and design. They have the advantage of being able to explore large search spaces and find good solutions even in the presence of complex, non-linear, or discontinuous fitness landscapes. However, it's important to note that genetic algorithms are not always the most efficient or suitable approach for every problem. They may require substantial computational resources and can be sensitive to parameter settings. In some cases, alternative algorithms like gradient-based methods or swarm intelligence techniques may be more appropriate.

Logical programming in artificial intelligence (AI) refers to the use of logical reasoning and formal logic to solve problems and make decisions. It involves representing knowledge and rules as logical statements and using inference mechanisms to derive new knowledge from existing information. This approach is often associated with the field of symbolic AI or knowledge-based systems.

In logical programming, the most commonly used formal logic is first-order logic, which includes concepts such as predicates, variables, quantifiers, and logical

connectives. First-order logic allows for the representation of facts and rules in a structured and declarative manner.

One of the prominent logical programming languages is Prolog (PROgramming in LOGic). Prolog is a declarative language that operates based on a resolution-based theorem proving mechanism. It provides a framework for defining facts, rules, and queries, and it uses unification and backtracking to find solutions to logical queries.

Logical programming in AI can be used for various tasks, including:

-Knowledge representation: Logical programming allows for the representation of knowledge in a structured and explicit manner. Facts, rules, and relationships can be represented using logical statements, enabling the AI system to reason about the available knowledge.

-Inference and reasoning: Logical programming facilitates logical inference, where new information can be inferred from existing knowledge using rules of deduction. The AI system can use logical reasoning mechanisms to answer queries, make decisions, or solve problems.

-Expert systems: Logical programming has been used extensively in the development of expert systems, which are AI systems designed to emulate the expertise of human experts in specific domains. Expert systems represent knowledge using logical rules and use logical inference to provide advice or make diagnoses.

-Planning and problem-solving: Logical programming can be employed for planning and problem-solving tasks. By representing the problem domain and the desired goals as logical statements, an AI system can use logical inference to derive a plan or a solution.

-Natural language processing: Logical programming can be integrated with natural language processing techniques to perform tasks such as natural language understanding, semantic parsing, and question answering. By mapping natural language sentences to logical representations, AI systems can reason about the meaning of the sentences using logical inference.

While logical programming has its strengths in handling symbolic reasoning and knowledge representation, it may face challenges in dealing with uncertainty, handling large-scale knowledge bases, and efficiently searching through complex problem spaces. Therefore, hybrid approaches that combine logical programming with other AI techniques, such as probabilistic reasoning or machine learning, are often used to overcome these limitations and achieve more robust and scalable AI systems.

Symbolic representation and processing of information in artificial intelligence (AI) refers to the use of symbols or discrete elements to represent knowledge, concepts, and relationships, and the manipulation of these symbols to perform intelligent tasks.

Symbolic representation involves assigning symbols to entities or concepts in the world. These symbols can represent objects, events, relationships, actions, or any other meaningful elements. For example, in a symbolic representation of a car, we may use symbols like "wheels," "engine," and "steering wheel" to represent its components. Symbolic processing, on the other hand, involves manipulating these symbols through logical operations, rule-based systems, or algorithms to derive new

knowledge, make inferences, or solve problems. This manipulation can include tasks such as pattern matching, deduction, induction, reasoning, and planning.

The symbolic approach to AI contrasts with other paradigms, such as connectionism or neural networks, which rely on distributed representations and numerical computation. Symbolic AI emphasizes the explicit representation of knowledge and the use of symbolic manipulation to perform reasoning and problem-solving tasks.

One of the main advantages of symbolic representation and processing is the transparency and interpretability it provides. Since the knowledge is represented explicitly, it is easier for humans to understand and validate the reasoning and decision-making processes of the AI system. Symbolic AI has been successfully applied in domains such as expert systems, natural language processing, and automated planning.

However, symbolic approaches also face challenges in dealing with uncertainty, handling large amounts of data, and capturing the nuances of real-world situations. In recent years, there has been a growing trend towards combining symbolic and sub-symbolic approaches to leverage the strengths of both paradigms. This hybridization allows for more flexible and robust AI systems that can handle both symbolic representations and data-driven learning.

Overall, symbolic representation and processing of information play a crucial role in AI, enabling the development of intelligent systems that can understand, reason, and manipulate knowledge in a human-like manner.

Artificial Intelligence (AI) is a rapidly evolving field, and advanced learning techniques play a crucial role in its development. Here are some advanced learning techniques used in artificial intelligence:

-Deep Learning: Deep learning is a subset of machine learning that utilizes artificial neural networks with multiple layers to extract high-level features from data. It has revolutionized AI by achieving state-of-the-art results in various tasks such as image recognition, natural language processing, and speech recognition.

-Reinforcement Learning: Reinforcement learning is a learning paradigm where an agent interacts with an environment and learns to make decisions based on rewards and punishments. The agent explores the environment through trial and error and adjusts its actions to maximize cumulative rewards. Reinforcement learning has been successfully applied in domains like game playing, robotics, and autonomous vehicles.

-Generative Adversarial Networks (GANs): GANs are a type of generative model that consists of two neural networks: a generator and a discriminator. The generator learns to generate synthetic data (e.g., images or text) that resembles real data, while the discriminator learns to distinguish between real and synthetic data. GANs have been used to create realistic images, generate text, and even enhance data for other AI applications.

-Transfer Learning: Transfer learning involves leveraging knowledge gained from one task or domain to improve learning or performance in a different, but related, task or domain. Instead of training a model from scratch, transfer learning allows the model to benefit from pre-trained models or knowledge learned from

previous tasks. It helps in situations where labeled data is scarce or the target task is similar to the source task.

-Unsupervised Learning: Unsupervised learning focuses on finding patterns, structures, or representations in data without explicit labels or feedback. Clustering, dimensionality reduction, and generative modeling are common techniques used in unsupervised learning. Unsupervised learning is valuable for tasks like anomaly detection, data visualization, and feature learning.

-Bayesian Learning: Bayesian learning involves the use of Bayesian statistics to update probabilities or beliefs based on new evidence. It provides a framework for reasoning under uncertainty and allows for probabilistic modeling, inference, and decision-making. Bayesian learning is useful when dealing with limited data or when incorporating prior knowledge into the learning process.

These are just a few examples of advanced learning techniques in AI. The field is dynamic, and researchers are continuously developing new approaches to enhance AI systems' capabilities and performance.

Natural Language Processing (NLP) is a subfield of artificial intelligence (AI) that focuses on the interaction between computers and human language. It involves the development and application of computational algorithms and models to enable computers to understand, interpret, and generate natural language text or speech.

NLP encompasses a wide range of tasks and techniques, including:

-Text Classification and Sentiment Analysis: Classifying text into predefined categories or determining the sentiment (positive, negative, or neutral) expressed in a piece of text.

-Information Extraction: Identifying and extracting specific information or structured data from unstructured text, such as extracting names, dates, locations, or other relevant entities.

-Named Entity Recognition (NER): Identifying and classifying named entities (such as person names, organizations, locations, or dates) in text.

-Language Generation: Generating human-like text or speech based on a given input or context. This can include tasks such as chatbots, machine translation, text summarization, or dialogue systems.

-Question Answering: Understanding questions posed in natural language and providing accurate answers based on the available knowledge or information.

-Machine Translation: Automatically translating text from one language to another.

-Speech Recognition: Converting spoken language into written text.

-Speech Synthesis: Generating spoken language from written text.

To accomplish these tasks, NLP leverages a variety of techniques and approaches, such as statistical modeling, machine learning, deep learning (including recurrent neural networks and transformer models), and rule-based methods. Large-scale language models, such as OpenAI's GPT, have made significant advancements in NLP by demonstrating the ability to understand and generate coherent human-like text.

NLP finds applications in numerous domains, including customer service, information retrieval, virtual assistants, content analysis, sentiment analysis,

healthcare, finance, and many others. Its goal is to bridge the gap between human language and machines, enabling computers to comprehend and interact with human communication in a more natural and meaningful way.

Evolutionary search algorithms are a class of optimization algorithms inspired by the process of natural evolution. These algorithms are commonly used in artificial intelligence (AI) to solve optimization problems where the solution space is large and complex. Here are some of the popular algorithms used in evolutionary search:

-Genetic Algorithm (GA): The genetic algorithm is one of the most widely used evolutionary search algorithms. It starts with a population of potential solutions encoded as individuals (often represented as strings or arrays). The algorithm applies evolutionary operators such as selection, crossover, and mutation to generate new offspring populations. The process continues iteratively until a satisfactory solution is found.

-Evolution Strategies (ES): Evolution Strategies is a family of algorithms that focuses on optimizing numerical parameters rather than discrete solutions. ES algorithms use a population of candidate solutions and apply mutation and selection operators to iteratively improve the solutions. Unlike genetic algorithms, evolution strategies usually operate on real-valued vectors or matrices.

-Genetic Programming (GP): Genetic Programming extends the idea of genetic algorithms to evolve computer programs or mathematical expressions. It uses a tree-based representation of programs and applies genetic operators such as crossover and mutation to generate new program trees. The fitness of each program is evaluated based on its ability to solve the given problem, and the process continues until a satisfactory program is evolved.

-Particle Swarm Optimization (PSO): Although not strictly an evolutionary algorithm, PSO is often categorized with evolutionary search methods due to its similar nature. In PSO, a population of particles moves through the solution space, and each particle adjusts its position based on its own experience and the experience of its neighbors. The particles search for the optimal solution by iteratively updating their positions until convergence.

-Ant Colony Optimization (ACO): ACO algorithms are inspired by the behavior of ant colonies. These algorithms use a population of virtual ants that explore the solution space by depositing pheromone trails. The pheromone trails guide the other ants towards promising regions. Over time, the paths with higher amounts of pheromone become more attractive, leading to the discovery of optimal solutions.

These algorithms vary in their representation of solutions, operators, and strategies for exploration and exploitation. Their effectiveness depends on the problem being solved and the appropriate configuration of algorithmic parameters. Evolutionary search algorithms have been successfully applied to a wide range of optimization problems, including function optimization, feature selection, scheduling, and neural network training, among others.

Search algorithms with memory refer to algorithms that incorporate memory or information about previously explored states or paths in order to guide the search process. These algorithms aim to improve efficiency and effectiveness by avoiding redundant exploration and leveraging past knowledge.

Here are a few examples of search algorithms with memory:

-Depth-First Search with Visited Nodes: Depth-First Search (DFS) is a popular graph traversal algorithm that explores as far as possible along each branch before backtracking. To avoid revisiting nodes, DFS can maintain a list or a set of visited nodes. This memory structure helps in pruning redundant paths and improves the algorithm's efficiency.

-Breadth-First Search with Queue: Breadth-First Search (BFS) explores all the vertices of a graph in breadth-first order, visiting all neighbors of a node before moving to the next level. To keep track of the visited nodes and ensure that no node is revisited, BFS typically uses a queue data structure. The queue stores the nodes that are yet to be explored, and as nodes are visited, they are added to the visited set or list.

-A* Search Algorithm: A* is a popular informed search algorithm that combines the principles of Dijkstra's algorithm and best-first search. A* uses heuristics to guide the search and make informed decisions about which nodes to explore next. It maintains a priority queue or a priority list based on a combination of the cost of reaching a node and an estimate of the remaining cost to the goal. The memory in A* helps in choosing the most promising paths and avoiding unnecessary exploration.

-Dijkstra's Algorithm: Dijkstra's algorithm is an algorithm for finding the shortest path between nodes in a graph. It uses a priority queue or a priority list to keep track of the nodes and their tentative distances from the source node. Dijkstra's algorithm assigns shorter distances to nodes as it explores the graph, effectively remembering the shortest paths found so far. This memory allows the algorithm to avoid reevaluating paths and find the shortest path efficiently.

-Iterative Deepening Depth-First Search: Iterative Deepening Depth-First Search (IDDFS) is a combination of DFS and BFS. It performs a series of depth-limited DFS searches with increasing depth limits. At each iteration, IDDFS remembers the explored nodes from the previous iteration to avoid revisiting them. IDDFS can find the shortest path in a tree or a graph and is particularly useful in scenarios where memory constraints exist.

These are just a few examples of search algorithms with memory. There are many other algorithms and variations that utilize memory structures to improve search efficiency and effectiveness.

These are just a few examples of artificial intelligence techniques. In reality, artificial intelligence comes from different approaches and methods, depending on the specific task and context.

Artificial intelligence (AI) methods encompass a broad range of techniques and approaches that aim to simulate human intelligence and perform tasks traditionally requiring human cognitive abilities. Here are some key features and methods commonly associated with AI:

-Machine Learning (ML): Machine learning is a subset of AI that involves the development of algorithms that enable systems to learn and make predictions or decisions based on data. ML methods include:

a. Supervised Learning: Algorithms are trained using labeled data to predict or classify new, unseen data based on patterns learned from the training set.

b. Unsupervised Learning: Algorithms learn patterns and structures in unlabeled data without predefined outcomes or labels.

c. Reinforcement Learning: An agent interacts with an environment and learns to make decisions by receiving feedback in the form of rewards or penalties.

-Deep Learning: Deep learning is a subfield of machine learning that uses artificial neural networks with multiple layers to process and learn from large amounts of data. Deep learning methods, such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs), have been successful in various domains like computer vision and natural language processing.

-Natural Language Processing (NLP): NLP focuses on enabling computers to understand, interpret, and generate human language. It involves tasks such as speech recognition, sentiment analysis, language translation, and text generation.

-Computer Vision: Computer vision involves teaching machines to understand and interpret visual information, such as images and videos. Techniques include image recognition, object detection, image segmentation, and image generation.

-Expert Systems: Expert systems use knowledge-based techniques to mimic the decision-making capabilities of human experts in specific domains. They typically consist of a knowledge base, an inference engine, and a user interface.

-Evolutionary Algorithms: Inspired by the process of natural selection, evolutionary algorithms use genetic algorithms and other evolutionary techniques to solve optimization and search problems. They involve generating a population of potential solutions and iteratively evolving them to find optimal or near-optimal solutions.

-Knowledge Representation and Reasoning: AI methods often involve representing knowledge in a structured or logical form and using reasoning algorithms to derive new knowledge or make inferences based on the existing knowledge.

These features represent a subset of the diverse methods and techniques employed in artificial intelligence. AI continues to evolve rapidly, and new methods and approaches are continually being developed to tackle increasingly complex problems.

-Robotics: AI plays a significant role in robotics, enabling machines to perceive their environment, make decisions, and perform tasks. Robotics combines AI methods with sensors, actuators, and mechanical systems to create intelligent robots capable of interacting with the physical world.

Robotics is a multidisciplinary field that combines computer science, engineering, and various other disciplines to design, develop, and use robots. A robot is a programmable machine that can autonomously or semi-autonomously carry out tasks and interact with its environment.

Robots can be classified into different types based on their characteristics and capabilities. Some common types of robots include industrial robots, medical robots, service robots, autonomous vehicles, humanoid robots, and drones. Each type of robot is designed for specific applications and tasks.

The field of robotics encompasses several key areas:

-Mechanical Engineering: This aspect focuses on the design and construction of robot bodies and mechanisms. It involves creating structures, joints, and actuators that enable robots to move and perform their tasks.

-Electronics: Robotics involves the integration of electronic components such as sensors, circuits, and microcontrollers into robots. These components enable robots to sense their environment, process information, and make decisions based on the data they receive.

-Computer Science: Robotics heavily relies on computer science principles and algorithms. This includes areas such as artificial intelligence (AI), machine learning, computer vision, and control systems. These technologies enable robots to perceive and interpret their surroundings, plan their actions, and adapt to changing environments.

Control Systems: Control systems are essential for governing the behavior and movement of robots. They involve feedback mechanisms that allow robots to monitor and adjust their actions based on sensor inputs. Control systems ensure that robots can perform tasks accurately and safely.

Human-Robot Interaction: As robots become more advanced, the field of human-robot interaction (HRI) focuses on designing interfaces and communication methods that allow humans to interact with robots effectively. HRI includes speech recognition, gesture recognition, and natural language processing to enable seamless interaction between humans and robots.

Applications of robotics are diverse and continually expanding. Some notable examples include:

Manufacturing: Industrial robots have been widely used in assembly lines for tasks such as welding, painting, and material handling. They increase productivity, precision, and safety in manufacturing processes.

Healthcare: Medical robots assist in surgeries, rehabilitation, diagnostics, and patient care. Surgical robots enable minimally invasive procedures, leading to faster recovery times and reduced risks.

Exploration: Robots are used in space exploration and deep-sea exploration to gather data and perform tasks in environments that are hazardous or inaccessible to humans.

Service Industry: Robots are increasingly employed in the service sector for tasks such as cleaning, delivery, and customer service. They can automate repetitive tasks and improve efficiency.

-Agriculture: Agricultural robots, also known as agribots, are used for tasks like harvesting, planting, and monitoring crop health. They help optimize farming processes and increase productivity.

-Education and Research: Robotics is used as an educational tool to teach students about programming, engineering, and problem-solving. It also serves as a platform for research in various scientific fields.

As technology advances, robotics continues to evolve, pushing the boundaries of what robots can achieve and their impact on society.

Artificial intelligence (AI) plays a significant role in the age of digitization by driving innovation, automation, and intelligent decision-making across various industries and sectors. Here are some key ways in which AI contributes to the digitization era:

-Automation and Efficiency: AI enables automation of repetitive and mundane tasks, freeing up human resources to focus on more complex and creative work. Intelligent algorithms and machine learning models can automate processes, analyze data, and perform tasks with speed and accuracy, leading to increased efficiency and productivity.

-Data Analysis and Insights: With the vast amount of data available in the digital age, AI helps in analyzing and extracting valuable insights. Machine learning algorithms can identify patterns, correlations, and trends within large datasets, providing businesses and organizations with actionable intelligence for informed decision-making and strategic planning.

-Personalization and Customer Experience: AI-powered systems can analyze user preferences, behavior, and historical data to deliver personalized experiences. This can be seen in recommendation engines used by online platforms, personalized marketing campaigns, and chatbots that provide tailored customer support. AI enables businesses to understand their customers better and offer customized products, services, and experiences.

-Natural Language Processing (NLP) and Conversational AI: NLP techniques enable machines to understand, interpret, and respond to human language, enabling more intuitive and natural interactions between humans and machines. Virtual assistants, chatbots, and voice-activated systems leverage NLP to provide conversational interfaces, helping users with tasks, answering questions, and providing information.

-Predictive Analytics and Forecasting: AI algorithms can analyze historical data and make predictions about future outcomes. This capability is invaluable in various fields, including finance, healthcare, logistics, and marketing. Predictive analytics helps businesses optimize operations, anticipate customer needs, mitigate risks, and make data-driven decisions.

-Cybersecurity and Fraud Detection: The digitization age brings new challenges in terms of cybersecurity and fraud. AI algorithms can monitor network traffic, detect anomalies, and identify potential threats in real-time. They can also analyze patterns of fraudulent behavior and detect anomalies, helping organizations prevent and respond to security breaches more effectively.

-Autonomous Systems: AI plays a critical role in enabling autonomous systems and technologies, such as self-driving cars, drones, and robotics. These systems rely on AI algorithms to perceive their environment, make decisions, and take actions without direct human intervention. Autonomous systems have the potential to transform industries like transportation, logistics, manufacturing, and healthcare.

It is important to note that while AI brings numerous benefits, it also raises ethical, privacy, and societal concerns that need to be addressed. Ensuring transparency, accountability, and responsible use of AI is crucial to harness its potential while mitigating potential risks.

Artificial intelligence (AI) encompasses a wide range of perspectives and opinions due to its diverse applications and potential impact on society. Here are a few common perspectives on AI:

Enthusiastic Optimism: Many proponents of AI believe it has the potential to revolutionize various industries, improve efficiency, and solve complex problems. They see AI as a powerful tool for advancing scientific research, healthcare, transportation, automation, and other areas. They believe that AI can enhance human capabilities, augment our decision-making processes, and bring about positive societal changes.

Ethical Concerns: Some people express concerns about the ethical implications of AI technology. They worry about issues such as privacy, data security, bias, and the potential for AI to reinforce existing inequalities. They emphasize the need for responsible development and deployment of AI systems, as well as transparency and accountability in decision-making algorithms.

Fear of Job Displacement: One common concern is that AI and automation will lead to significant job displacement, particularly in industries that heavily rely on repetitive or routine tasks. Critics worry that widespread adoption of AI could result in unemployment and exacerbate socioeconomic inequalities. Proponents argue that while some jobs may be replaced, new opportunities will emerge as AI creates new industries and enhances existing ones.

Technological Singularity: The concept of technological singularity refers to a hypothetical point in the future where AI surpasses human intelligence, leading to unforeseeable consequences. Some believe that reaching this point could bring about either tremendous benefits or significant risks. Views on this topic vary, with some expressing excitement about the potential advancements while others are concerned about the loss of control and unforeseen outcomes.

Collaboration and Human-AI Interaction: Many experts advocate for collaboration between humans and AI systems, emphasizing the importance of designing AI as a supportive tool that complements human abilities. They see AI as a means to amplify human intelligence, creativity, and problem-solving skills. The focus is on developing AI systems that can understand human values, communicate effectively, and work alongside humans in a beneficial manner.

Regulation and Governance: The question of how to regulate and govern AI is an ongoing debate. Some argue for strict regulations to ensure the responsible and ethical use of AI, while others advocate for a more open and flexible approach to foster innovation. Striking the right balance between encouraging technological progress and safeguarding against potential risks is a complex challenge faced by policymakers and experts.

These perspectives highlight the multifaceted nature of AI and the diverse opinions surrounding its development, deployment, and societal impact. The ongoing discourse helps shape the direction of AI research, development, and governance to maximize its benefits while addressing concerns and mitigating risks.

AI is also finds its expression in the new culture. For example, the creation of neural networks by Google proved themselves in the field of fine art and taught to

create paintings for the styles of famous artists [3]. A new AI religion (Artificial Intelligence Religion) was created that forms a new cultural dimension to the perception of technology in society [4]. The spread of these innovations could mean the emergence of new types of human activity in AI sphere, including in the economic in the near future.

Global market trends AI somehow gains are determined by the leading countries of the world. There is the possibility of Ukraine to become active member in the process creating AI technology, while using the existing intellectual and IT potential

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6. FUTURE EDUCATION IN THE AGE OF ARTIFICIAL INTELLIGENCE

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The future is not just a place we are going to, but also a place we are going to create, so it is not only a concept of time. Understanding the future from the perspective of education is a better educational expectation, an appeal for educational reform, and a yearning for educational modernization. Future education is a demand for change, transformation and development. Dewey once said a word: Today's education and teachers do not live in the future, and future students will live in the past. This is also a way for education to face the uncertainty of the future. Therefore, I think the future, understood from the perspective of education, should transcend the concept of time. One should have a belief in understanding the form of future education. Future education is a transcendent appeal for change. Its specific form may vary widely, but its development direction and development concept are deterministic.

The transformational impact of artificial intelligence on other fields and industries will also extend to the field of education, because education is a career related to the overall development of society. On the one hand, the role of artificial intelligence in enhancing, replacing, improving, and changing is prominently reflected in the reshaping of industries in various fields of social production and life, as well as the release of manpower. On the other hand, these reshaping functions and the release of manpower have triggered changes in social fields and industries, and

have prompted a shift in the demand for social talents; education is an important area for the export of social human resources, and it is necessary to make a strong response to this, thus giving birth to Educational ecological upgrade.

Artificial intelligence has accelerated the process of deepening reform in education and promoted the renewal and reconstruction of the system. Digital technology has had a profound impact on educational elements such as teachers and students, courses, teaching methods, learning experience, evaluation, and management, and has changed the educational ecology through gradual reengineering of the educational process. Artificial intelligence is further accelerating this process, expanding the connotation of each element in the system, improving and extending the internal relationship of the system, and reshaping the function and form of the education system in a disruptive and innovative manner.

Artificial intelligence expands the boundaries of education and boosts the construction of future schools. In the future, schools will use the power of technology to include off-campus learning places (such as science and technology museums, museums) and online learning places into the scope of "schools", integrate educational resources in various fields of society, and form a new education environment. At the same time, new technologies such as digital twins promote the interactive integration of real space and virtual space, and realize the two-way mapping, dynamic interaction and real-time connection between physical space and digital space by creating digital twins of people, objects and environments. The upgrading and transformation of the education system and the expansion of space resources can better connect it with the social field and provide a place for the growth of innovative talents suitable for future life and work.

The development of artificial intelligence technology will bring about major structural changes in future education, and learning will become ubiquitous. The teaching environment, learning environment, and the basic organizational parts of the school will change, the school's operating model, operating rules, and operating rules will undergo changes, and the structure and form will be reorganized. There are six very important trends in this restructuring process:

Artificial intelligence has triggered profound changes in many fields and industries, and the systemic changes in education are imminent, bringing the possibility of changes in learning methods. First of all, artificial intelligence technology brings the possibility of personalization of large-scale education. The smart learning environment built by artificial intelligence not only creates a flexible learning space, but also perceives the learning situation, identifies the characteristics of students, and provides personalized learning support for students. Secondly, artificial intelligence technology brings the possibility of adaptability under standardized education. Through the adaptive learning mechanism of dynamic learning diagnosis, feedback and resource recommendation, artificial intelligence can adapt to the dynamically changing learning needs of students, thereby breaking the standardized education restrictions and releasing students' creativity and vitality.

Finally, artificial intelligence improves the structured teaching method, releases the creativity and teaching vitality of teachers, and focuses on humanized learning

design. The tedious and repetitive work of teachers can be replaced by intelligent machines. Intelligent analysis technology can accurately locate the learning problems and needs of students for teachers. The role of teachers will turn to better learning designers, focusing on "how to let students learn well" Cultivate students' ability and thinking, spend more time on learning activity design and personalized interaction with students, and provide students with personalized learning support services. The development of artificial intelligence and its deep integration with education and teaching have brought more choices to the reform and innovation of education. Education needs to give full play to the advantages of technology empowerment, empowerment, and enablement to meet the functional pursuit of education, and it is also necessary to stick to the goal of education. The original intention and mission of educating people conveys humanistic value, explores practical learning methods and learning design based on the growth and development of students, and releases greater vitality of education through artificial intelligence.

Future education should pay more attention to the individuality and diversity of students. Einstein once said that "everyone is a genius. If you judge a fish's ability by its ability to climb a tree, then the fish will consider itself a fool for the rest of its life." Therefore, future education is an education that respects students' individuality and future development. With the support of artificial intelligence technology, we can go beyond the personalized and small-scale education in agricultural society, and the large-scale and non-personalized education in industrialized society. We can establish a system that can achieve both large-scale coverage and An education system with individual support.

There are three core keywords in future education, namely personalization, adaptability and selectivity. Future learning will no longer reproduce the scene of attending classes in schools in accordance with fixed courses, classes, and rhythms in the past. Personalized learning will receive more attention, and education that develops students' individuality will become an important direction of educational development. Based on artificial intelligence technology, it can accurately understand the cognitive structure, ability structure and emotional characteristics of learners, so as to present the knowledge and content, strategies and methods that are most suitable for the characteristics of current learners. At the same time, the school will integrate online education into it, provide more choices for learners, and support students to choose a flexible education that suits their own personality.

Establishing an education system that promotes personality development based on big data and artificial intelligence is the basic trend of future school development. In the future, on the basis of complete recording and analysis of students' learning data and an accurate understanding of each student's personality characteristics, an online and offline integrated, personalized, selective and accurate teaching space can be established, and accurate recommendations can be made. Authoritative knowledge, learning data, learning content and learning activities, as well as domain experts, carry out evaluations oriented to the learning process, increasing the adaptability and optionality of learning.

Future education is education that promotes the all-round development of people. We must pay attention to the core literacy of people and cultivate people with all-round development. The future society must be a highly intelligent society. The people we cultivate should not be able to compete with machines with simple thinking and simple calculations, but to cultivate human wisdom, comprehensive quality, and comprehensive ability, and to cultivate human personality, kindness, and compassion, so that they are full of human qualities. Wisdom, human knowledge, ability to solve practical problems, deep insight, and ability to take responsibility for one's own life and society. This is the reason why our country's new round of reforms emphasizes core literacy. This is the background of the times and the development direction of the times—we want to cultivate people with all-round development.

In the era of artificial intelligence, we must be good at using the thinking mode of combining man and machine. At present, data, information, and knowledge are expanding rapidly at a rate of doubling every few years, and the gap with the learning time and cognitive ability of each of us is getting bigger and bigger. Only by using the way of thinking that combines man and machine can education achieve both large-scale coverage and personalized development that matches individual abilities. The human-computer thinking system is a very important direction of change in our future way of thinking. A person's intelligence is limited, and the combination of humans and computers can break through the limit of individual human cognition, enabling us to control the complexity beyond the limit of individual cognition, to handle massive amounts of information beyond personal cognition, and to deal with problems beyond the limits of individual cognition. Rapid changes in the limits of cognitive ability.

Future education should pay more attention to the soul and happiness of students. Future-oriented education should respect and care for students more, be student-oriented, and lay the foundation for students' lifelong happiness and growth. About 1/4 of our time is spent in school, and this 1/4 of the time is not only preparing for the future school, but also a very beautiful form of life.

Artificial intelligence will bring about the liberation of teachers' intellectual labor. Teachers will have more time and energy to care about students' hearts, spirits and happiness, and have more time to interact with students on an equal footing, stimulate students' nature of seeking knowledge, and be able to implement more human-oriented teaching .

In the future, education will be integrated into life, and learning is a form of life that is lifelong and comprehensive. In the future school, learning, work and life are integrated, and learning and education are not just about acquiring a certain skill. Education itself is the growth of the soul, a ladder that enables us to feel better things. In the future of education, the organization of traditional teaching will change. Learning behavior is no longer limited to schools. It breaks through the boundaries of time and space and the restrictions of educational groups. Everyone, anytime, anywhere can learn. Learning will be everywhere, and the era of "Ubiquitous Learning" (Ubiquitous Learning) is coming. Anyone, anywhere, any time, using any

device can obtain any information and knowledge they need. Ubiquitous learning is based on the needs of the learners themselves, enabling people to acquire a lot of knowledge and skills that can be immediately applied to practice. It occurs according to time, place and demand, and is a self-directed process. It is a process of appropriate learning, providing knowledge and information to learners when they need them most, no matter what kind of place they are in. Learning will be an on-demand learning.

Future school education and non-formal school education are complementary and mutually integrated. The supply of education must be socialized. High-quality educational resources and educational services do not necessarily come only from your school. They can completely cross the boundaries of the school and be provided by external institutions and individuals. The form of future education must be The combination of virtual space and real space can cross organizational boundaries. The core elements of the entire education system will be reorganized and reconstructed. Learning consumers, content providers, teaching service providers, fund providers, test providers, and certificate providers may all come from social institutions. Public welfare organizations, specialized scientific research institutes, Internet education companies and other social institutions will become important sources of high-quality education supply.

As the core technology that triggers the fourth scientific and technological revolution, artificial intelligence promotes the exponential development of social economy and technology, and creates new demands for the quality and supply of human capital. The interdependence between artificial intelligence and human resources has created an unprecedented The tension of education and the advancement of education have been challenged unprecedentedly. First, the exponential development of knowledge growth creates great uncertainty in what aspects of preparation future talents will need.

Under the influence of artificial intelligence, human knowledge production has intensified changes, and knowledge increments have shown an exponential trend. The inheritance development of education will no longer be limited to the imparting and inheritance of knowledge, but will emphasize knowledge creation and innovation, and the intervention of artificial intelligence will give birth to a new mode of knowledge production.

First, the powerful knowledge discovery ability of artificial intelligence shortens the knowledge production cycle. With the development of new machine learning algorithms such as deep learning and reinforcement learning, artificial intelligence can not only accelerate the production, access and utilization of knowledge, but also extract implicit, unknown, potential and useful information from data (knowledge), thereby expanding the ability of knowledge creation.

Second, the intelligent model of man-machine collaboration expands the opportunities and possibilities of knowledge creation. Artificial intelligence technology not only promotes the collaborative innovation of human group intelligence, but also realizes the collaboration between humans and artificial

intelligence agents. The super computing power of the latter can greatly accelerate knowledge production, promote the creation of knowledge, and human-machine collaborative knowledge innovation. The challenge of the new knowledge production mode spawned by artificial intelligence to education is that education is no longer limited to knowledge inheritance, but more knowledge innovation. In the future, school education must teach students how to cooperate with artificial intelligence technology, care for learners' ability to learn, and attach great importance to the cultivation of students' ability to distinguish and analyze knowledge, call on learners to "know how to learn", and promote learners to realize knowledge in human-computer interaction. Renew and create.

Second, the proportion of intellectual workers has increased, and innovative talents have become a rigid demand for the development of the times. The deep integration of artificial intelligence technology and the production process will greatly reduce the demand for practitioners in the production field, especially those fields where artificial intelligence wins.

Third, the rise of artificial intelligence technology has led to a broader development space for high-tech industries, emerging industries, and new service industries, which has led to a sharp increase in the demand for innovative talents, interdisciplinary talents, and high-tech talents in the labor force structure. Creativity, flexibility, humanity and other abilities that cannot be replaced by artificial intelligence technology will become the key to talent competition in the era of intelligence. Education shoulders the mission of cultivating innovative talents and planning ahead for future talents.

Looking back at history, we can learn from the experience that only when education is ahead of the pace of technological development and human resources are prepared in advance for a technology-promoted society can social development have stamina. Therefore, as artificial intelligence promotes the rapid development of society today, it is necessary to answer the question of what kind of education can carry the mission of laying out human resources in advance to meet the challenges of talents in an unknown society.

The walls of schools are being broken, and the opening of schools is the general trend, and more and more sources of high-quality educational services will emerge from professional social institutions. In the future of education, students and parents can combine educational services from schools or the Internet to develop personalized learning courses and activities to reflect children's personalities, interests, and parents' goals and values. Perhaps the form of the future school is a kind of self-organization. On the premise of accurately understanding the students' learning data, students can completely cross the school boundary and organize their own learning services.

Future education is the collaboration of human and artificial intelligence. Artificial intelligence will bring online and offline integration of new forms of educational services that cannot be provided by traditional education, such as automatic correction, artificial intelligence problem solving, social learning,

dynamic prediction of learning outcomes, instant feedback, online tutoring, online Q&A, etc. For example, Georgia Institute of Technology in the United States used IBM's Watson robot instead of teaching assistants to teach students for five months. Students can ask the robot if they have any questions. During this period, no students found it difficult to use or the effect was not good.

The role of artificial intelligence teachers in the future mainly includes but is not limited to the following 12 aspects: teaching assistants who can automatically generate questions and review homework automatically, analysts who can automatically diagnose and give feedback on learning disabilities, coaches who improve the quality of problem-solving ability assessment, and students. Counselors for quality assessment and improvement, health doctors for physical health testing and improvement, head teachers for feedback on comprehensive quality evaluation reports, guidance consultants for personalized intelligent teaching, intelligent tutors for students' personalized problem solving, career planners for students' growth and development, Mutual assistance partners in precise teaching and research, intelligent agents for the generation and aggregation of personalized learning content, and data-driven educational decision-making assistants.

The future of education will enter the era of cooperation and coexistence between teachers and artificial intelligence. Teachers and artificial intelligence will give full play to their respective advantages to jointly realize personalized education, inclusive education, fair education and lifelong education, and promote the all-round development of people. The role of teachers in the future supported by artificial intelligence will undergo great changes, and the knowledge-based teaching role of teachers will be replaced by artificial intelligence; the role of teachers in educating people will become more and more important, and we will move towards the collaboration between teachers and artificial intelligence future education era.

Artificial intelligence is changing the world.

The world is now focusing on the impact of generative artificial intelligence tools on the knowledge and creative economy. Schools are centers of knowledge and creative work, and so are likely to be the first places where the general public sees tangible change. Leaders and visionaries around the world are actively promoting the application of rapidly developing artificial intelligence technology. The rate at which AI technology develops is measured in days and weeks, not months and years, and it's only going to get faster. The accelerated development of AI capabilities and applications means that its potential impacts, both positive and negative, are also rapidly increasing.

Generative AI systems are evolving and will also have broad implications for the education system. Schools will change how they operate, teachers will change how they work, and students will change how they develop personally and professionally. Our young generation, as always, has been a leader in the application and development of these new technologies. The term "digital native" seems to be outdated, and it's inevitable that Generation Z and those who come after will become experts in these new technologies faster than many adults. We need to treat young people as truly knowledgeable experts, and doing so can open up new and exciting

use cases and applications for new technologies such as generative artificial intelligence.

Applying the power of artificial intelligence to solve the challenges of our schools and system design presents equally incredible opportunities. AI can now help teachers design lessons, analyze student performance data to design learning interventions and new lesson plans. But the potential for AI to do other jobs is clear. In a rapidly evolving global economy, artificial intelligence can help us better understand the day-to-day at school and all the learning experiences it entails. AI can help states and territories develop new career paths and lifelong learning structures that put learners on the path to gainful employment within decades.

Students also need to learn and understand artificial intelligence technology. Some competent and knowledgeable educators can help, and students may use these tools in ways we cannot currently imagine. Armed with powerful technology, young learners can thrive in the rise of intelligent machines when equipped with the right scaffolding. It is important that we provide this opportunity to all learners; failure to do so will only increase inequality and widen gaps in new ways.

Education should serve the national strategic layout, build first-mover advantages in order to seize opportunities for the development of artificial intelligence; export innovative talents for international competition and social development, and support independent research and development of science and technology. At present, countries all over the world have raised the development of artificial intelligence to the height of national strategy, in order to seize the opportunities of a new round of technological revolution and the initiative in global competition. The "New Generation Artificial Intelligence Development Plan" puts forward the strategic goal of "becoming the world's main artificial intelligence innovation center" in my country, and overall deployment of important aspects such as economy, education, technology, social development and national security.

The strategy of strengthening the country through education is the logical starting point of important strategies such as the strategy of rejuvenating the country through science and education, the strategy of strengthening the country with talents, and the strategy of innovation-driven development. Artificial intelligence puts forward higher requirements for the ability of education to cultivate talents. In recent years, countries around the world are also facing huge challenges while developing artificial intelligence, such as the problem of innovative talents, the problem of independent control of high-tech, etc. The essence of international competition in artificial intelligence is a contest of talents, which requires education to respond from a strategic level.

Therefore, for education to play a leading role in strategy, it is necessary to give full play to the advantages of intelligent technology to promote the upgrading of the education ecosystem, and to plan a layout to provide talent support for national development. Based on the mutual shaping perspective of technology and education in the competition, the exploration of artificial intelligence to promote the

development of future education needs to seize the opportunity strategically, output innovative talents for various fields of society through education, and support the transformation and upgrading of various fields of society and artificial intelligence. The innovative development of high-tech such as intelligence has injected continuous vitality and energy into the strategy of strengthening the country.

In the competition with technology, education jointly promotes the development of society. Education has the characteristics of advancement, humanity, inheritance, strategy and ecology. In the face of the exponential development of artificial intelligence technology, the advanced nature of education has become difficult to maintain; there is a time-space see-saw and contradiction between the humanism that requires slow work and meticulous work and the tool that meets the needs of social employment; the inheritance of human knowledge has changed. As a historical inheritance, interpersonal co-creation and human-machine co-creation have multiple characteristics. With the acceleration of the development driven by artificial intelligence technology, the development strategy and forward-looking planning of education are important issues that cannot wait for our time and have a long way to go.

As we bring the fruits of technological innovation into classrooms and beyond, our goal must always be to democratize learning opportunities. There are certainly challenges, but human ingenuity is real and powerful, and these challenges can certainly be met effectively. A new era of learning is coming, and it is important to have a correct understanding of this. The center of education is the essence of human prosperity, we must deploy artificial intelligence in the field of education. AI technologies can enhance student learning, ensuring that future generations can thrive in more humane and humane ways. In a better tomorrow, all our children and our planet will grow stronger and stronger.

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7. ARTIFICIAL INTELLIGENCE AND IMPLEMENTATION OF INTERNET TECHNOLOGIES IN TOURISM

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Artificial intelligence (AI) in tourism refers to the application of various technologies and processes that utilize AI algorithms to analyze and process a vast amount of information in the tourism industry. These technologies and processes aim to enhance various aspects of the tourism experience, including travel planning, customer service, personalization, and decision-making. Today you can talk about the emergence of a global tourism product that represents the aggregate offer of many participants of the international tourist market, ready for sale at any moment to any buyer, regardless of territorial affiliation and form of ownership [1, p. 38].

In modern conditions, travel companies can use the Internet in four ways:

-create a web page on which to post information about the company and its services;

-advertise on the Internet;

-participate in newsgroups;

-to communicate by means of e-mail (including to carry out advertising mailings by e-mail [2, p.54-57]).

Here are some examples of how AI is used in tourism:

-Travel Recommendations: AI algorithms can analyze large volumes of data, including user preferences, historical trends, and social media data, to provide personalized travel recommendations. These recommendations can include destinations, attractions, accommodations, and activities that align with the traveler's interests and preferences.

-Chatbots and Virtual Assistants: AI-powered chatbots and virtual assistants are used to provide instant customer support and answer travelers' queries. These intelligent systems can handle common inquiries, provide recommendations, and assist with bookings, thereby improving customer service and response times.

-Natural Language Processing: AI technologies based on natural language processing (NLP) enable tourism companies to understand and interpret customer reviews, feedback, and social media conversations. By analyzing this data, businesses can gain insights into customer sentiments, preferences, and trends, allowing them to improve their services and offerings.

-Dynamic Pricing: AI algorithms can analyze market demand, customer behavior, and various factors to optimize pricing strategies dynamically. This helps tourism companies adjust prices in real-time based on factors such as demand, availability, and competitor pricing, ultimately maximizing revenue.

-Image and Video Analysis: AI can analyze visual content, such as images and videos, to automatically extract information and provide relevant insights. For example, AI can identify landmarks in photos, analyze user-generated content to understand destination preferences, or even assist in virtual tours by providing real-time information about the points of interest.

-Predictive Analytics: AI algorithms can analyze historical data and patterns to make predictions about future trends and demand. This can help tourism businesses make informed decisions regarding resource allocation, capacity planning, marketing campaigns, and other strategic initiatives.

-Smart Destination Management: AI technologies can assist in managing and optimizing the operations of tourist destinations. For example, AI-powered systems can monitor crowd levels, traffic patterns, and environmental conditions to enable better crowd management, improve safety measures, and enhance overall visitor experience.

-Language Translation: AI-powered translation tools can bridge the language barrier by providing real-time language translation services. This helps travelers communicate with locals more easily, leading to improved interactions and a smoother travel experience.

These are just a few examples of how AI is applied in the tourism industry. The use of AI technologies continues to evolve, offering new possibilities for streamlining operations, enhancing customer experiences, and driving innovation in the tourism sector. Artificial intelligence is a complex of technologies and processes that can process a large array information This includes virtual agents (chatbots, virtual assistants). Virtual agents, including chatbots and virtual assistants, are computer programs designed to interact with users through natural language processing (NLP) and artificial intelligence (AI) techniques. These agents simulate human-like conversations, providing information, answering questions, and performing tasks for users.

Chatbots and virtual assistants can be found in various platforms, such as websites, messaging apps, and voice-activated devices. They offer a range of functionalities and applications across different industries, including customer service, support, sales, and personal assistance.

Here are some key features and benefits of virtual agents:

-Natural language processing: Virtual agents are equipped with NLP capabilities to understand and interpret user queries and responses. They can analyze the meaning behind the text or speech and provide appropriate responses.

-24/7 availability: Unlike human agents, virtual agents can operate around the clock, providing instant assistance to users at any time. This ensures uninterrupted service and support for customers.

-Scalability: Virtual agents can handle multiple conversations simultaneously, making them highly scalable. They can assist numerous users simultaneously without delays, ensuring efficient customer service.

-Consistency: Virtual agents provide consistent and accurate responses, eliminating human errors and variations in service quality. They follow predefined scripts and guidelines, ensuring a uniform experience for users.

-Cost-effective: Implementing virtual agents can be cost-effective compared to maintaining a large team of human agents. Once developed and deployed, they can handle a significant volume of interactions without additional resources.

-Multichannel support: Virtual agents can be integrated across various platforms, including websites, messaging apps, and social media. They offer consistent support across multiple channels, providing users with convenient access to information and assistance.

-Automation and task completion: Virtual agents can automate routine tasks and transactions, such as booking appointments, placing orders, or retrieving information. This frees up human agents to focus on more complex and specialized tasks.

-Personalization: Advanced virtual agents can utilize AI and machine learning algorithms to learn from user interactions and provide personalized experiences. They can understand user preferences, tailor recommendations, and adapt to individual needs.

-Continuous improvement: Virtual agents can collect data on user interactions, enabling organizations to analyze customer behavior, identify patterns, and refine their services. This data-driven approach helps enhance the virtual agent's performance over time.

-Integration with backend systems: Virtual agents can be integrated with existing databases, CRM systems, or knowledge bases to access and retrieve relevant information. This allows them to provide accurate and up-to-date responses to user inquiries.

Overall, virtual agents offer a versatile and efficient way to engage with users, automate tasks, and deliver personalized experiences. As AI and NLP technologies continue to advance, virtual agents are becoming more sophisticated, capable of understanding complex queries, and providing increasingly human-like interactions. This technology allows quickly process and provide information, improves the quality and security of services.

With the help of artificial intelligence, you can improve the quality of customer service at the expense of personalization of services (NEC NeoFace Express technology). Yes, artificial intelligence (AI) can indeed help improve the quality of customer service in various ways, including through the use of technologies such as NEC NeoFace Express. NEC NeoFace Express is a facial recognition technology that can analyze and identify individuals based on their facial features. While it has several applications, including security and access control, it can also be utilized in customer service to enhance the overall experience.

By leveraging AI-powered facial recognition technology like NEC NeoFace Express, businesses can streamline and personalize customer interactions. Here's how it can contribute to improving customer service:

-Efficient identification: Facial recognition technology allows for quick and accurate identification of customers. This can eliminate the need for manual verification processes or the requirement of customers to provide identification documents repeatedly. As a result, it speeds up the service delivery process, reducing waiting times and enhancing efficiency.

-Personalized service: By recognizing customers, businesses can retrieve their information and preferences from databases or customer relationship management (CRM) systems. This enables service representatives to have a better understanding of customers' past interactions, preferences, and purchase history. Armed with this knowledge, customer service agents can provide personalized recommendations and tailored assistance, leading to a more satisfying and relevant customer experience.

-Enhanced security: AI-powered facial recognition can contribute to enhanced security measures in customer service settings. It can help prevent identity fraud and unauthorized access by verifying the identity of customers in real-time. This can be particularly valuable in sectors such as banking, telecommunications, and healthcare, where ensuring the privacy and security of customer data is crucial.

According to a report by the consulting company McKinsey & Company, the penetration of artificial intelligence in any field of business increased by 56% compared to 2019. In other words, it is already a tool of today with many applications [2].

While the use of AI technologies like NEC NeoFace Express can enhance customer service quality through increased efficiency and personalization, it's important to strike a balance to address potential privacy concerns. Businesses must ensure they comply with applicable privacy laws and regulations, obtain necessary consent from customers, and have appropriate data protection measures in place.

Overall, leveraging AI in customer service can be beneficial, as long as it is implemented responsibly and ethically to maintain a balance between personalization and privacy.

Yes, fast is an important competitive advantage formation of services that are most suitable for a certain client. For this, it is necessary to collect a large array information about the client's previous tourist experience, which is helped by artificial intelligence. Yes, fast is indeed an important competitive advantage in today's business landscape. The ability to provide prompt and efficient services can give a company an edge over its competitors. Customers value quick turnaround times, rapid responses, and timely delivery of products or services.

In the context of forming services that are most suitable for a certain client, speed can be crucial. By swiftly identifying a client's specific needs and tailoring services to meet those requirements, a company can establish a strong rapport and position itself as a reliable and responsive provider. This involves understanding the client's preferences, expectations, and unique challenges, and then swiftly adapting to deliver a personalized solution.

However, it's important to note that while speed is valuable, it shouldn't come at the expense of quality. It's crucial to strike a balance between efficiency and excellence in order to provide a superior customer experience. Clients also appreciate

accuracy, attention to detail, and a high standard of service, so it's essential to prioritize these aspects alongside speed.

Ultimately, combining the ability to deliver services quickly with a deep understanding of clients' needs can be a powerful competitive advantage that fosters customer loyalty and attracts new business.

Artificial intelligence (AI) and the implementation of Internet technologies have had a significant impact on the tourism industry. These advancements have revolutionized various aspects of the tourism sector, including customer service, marketing, and operations. Here are some ways AI and Internet technologies have been implemented in tourism:

-Personalized Recommendations: AI algorithms can analyze vast amounts of data, including customer preferences, previous bookings, and online behavior, to provide personalized recommendations to travelers. This enables travel agencies and online platforms to offer tailored suggestions for destinations, accommodations, activities, and attractions based on individual preferences, improving the customer experience.

-Chatbots and Virtual Assistants: Chatbots powered by AI are being used by many tourism companies to provide instant customer support and assistance. These chatbots can handle basic inquiries, provide information about bookings, and offer personalized recommendations. Virtual assistants, like voice-activated devices or smartphone assistants, can also assist travelers by providing directions, suggesting activities, and answering questions.

-Dynamic Pricing: AI algorithms can analyze market trends, demand patterns, and competitor pricing to adjust prices dynamically in real-time. This allows travel companies to optimize their pricing strategies and offer competitive prices to attract customers while maximizing revenue.

-Natural Language Processing (NLP): NLP technology enables AI systems to understand and process human language, facilitating communication between travelers and tourism companies. NLP is used in chatbots, voice assistants, and translation services to understand and respond to customer queries, provide language support, and enhance communication across different languages and cultures.

-Predictive Analytics: With access to large datasets, AI can analyze historical and real-time data to predict trends, demand patterns, and customer behavior. Tourism companies can use these insights to make informed decisions about marketing campaigns, inventory management, resource allocation, and capacity planning.

-Smart Destinations: Internet technologies, such as the Internet of Things (IoT) and sensors, can be integrated into tourist destinations to provide real-time information and improve the overall experience. For example, smart cities can use IoT devices to monitor traffic flow, optimize transportation routes, and provide interactive maps and guides to visitors.

-Virtual Reality (VR) and Augmented Reality (AR): VR and AR technologies have enhanced the way travelers experience destinations. Virtual reality allows users to explore and visualize locations before making bookings, while augmented reality

can overlay digital information onto real-world environments, offering interactive guides, historical information, or additional content during sightseeing.

-Data Analytics and Insights: AI and Internet technologies enable tourism companies to collect and analyze vast amounts of data, providing valuable insights into customer preferences, behavior patterns, and market trends. These insights can be used to optimize marketing strategies, improve operational efficiency, and develop targeted offerings.

Overall, the implementation of AI and Internet technologies in tourism has transformed the industry, providing personalized experiences, improving operational efficiency, and enhancing customer satisfaction. As technology continues to evolve, we can expect further advancements and innovative applications in the tourism sector.

Experts often use as an example a virtual tourist assistant - a tourist assistance system that works through a conversational chatbot based on artificial intelligence with neural networks. Thanks to this, it provides interaction through simple menus, which are configured using decision trees. In addition, text translation is possible using the natural language processing module [3].

Artificial Intelligence (AI) offers several advantages in the tourism industry, enhancing various aspects of the travel experience for both travelers and businesses. Here are some of the key advantages of AI in tourism:

-Personalized recommendations: AI can analyze vast amounts of data about a traveler's preferences, past behaviors, and demographic information to provide personalized recommendations. This helps travelers discover relevant destinations, accommodations, attractions, and activities that match their interests, leading to a more tailored and enjoyable experience.

-Efficient travel planning: AI-powered virtual assistants and chatbots can assist travelers in planning their trips. These tools can provide real-time information about flights, accommodations, local attractions, and transportation options, helping travelers make informed decisions quickly and efficiently. They can also handle bookings and reservations, saving time for both travelers and travel agents.

-Enhanced customer service: AI chatbots and virtual assistants can offer 24/7 customer support, answering frequently asked questions, resolving common issues, and providing instant assistance. This improves customer service by reducing response times, increasing availability, and ensuring consistent and accurate information is provided to travelers.

-Improved safety and security: AI can contribute to safety and security in various ways. For instance, it can monitor and analyze data from multiple sources, such as security cameras, social media, and travel records, to identify potential risks and threats. AI systems can also assist in screening luggage, detecting security breaches, and identifying suspicious behaviors, enhancing overall safety measures.

-Data-driven insights and decision-making: AI algorithms can analyze large volumes of data, including customer reviews, feedback, and social media sentiments, to extract valuable insights. These insights help tourism businesses understand customer preferences, identify trends, and make data-driven decisions regarding pricing, marketing strategies, product development, and resource allocation.

-Efficient resource management: AI can optimize resource management for travel companies, such as airlines and hotels, by predicting demand patterns and adjusting prices dynamically. AI algorithms can also optimize inventory management, energy consumption, and staffing levels, leading to cost savings and operational efficiencies.

-Language translation and communication: Language barriers can be overcome with AI-powered translation tools. These tools can instantly translate languages, both in written and spoken form, facilitating communication between travelers and locals. This improves interactions, promotes cultural exchange, and helps travelers navigate foreign destinations more effectively.

-Virtual reality and augmented reality experiences: AI technologies, combined with virtual reality (VR) and augmented reality (AR), can create immersive experiences for travelers. VR and AR can offer virtual tours of destinations, historical sites, and attractions, allowing travelers to explore and experience them remotely. This enhances the pre-travel research process and provides unique experiences for those who may have physical limitations.

Artificial intelligence can be blamed for some hype, but in the field of transportation, such an assistant is really useful. For example, the bot can independently book a ticket for the next flight, in the event of a force majeure incident with the current flight. The system will find the most relevant offer, according to the parameters of the user's previous selection [4].

These advantages of AI in tourism demonstrate its potential to revolutionize the industry, making travel experiences more personalized, efficient, and enjoyable for travelers while enabling businesses to improve their operations and better meet customer needs.

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8. ARTIFICIAL INTELLIGENCE AND EMPLOYMENT IN THE AGE OF DIGITALIZATION

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A new era of upheaval is on the horizon for the global job market, as technologies like artificial intelligence accelerate the decline of paper work while increasing demand for technology and cybersecurity professionals. The advent of artificial intelligence (AI) and the digitalization of various industries have undoubtedly had a significant impact on employment. While AI offers tremendous potential for innovation and efficiency, it also raises concerns about the displacement of human workers. Let's discuss the relationship between AI, employment, and digitalization in more detail.

-Automation and Job Displacement: AI-powered automation has the potential to replace certain repetitive and mundane tasks traditionally performed by humans. Industries such as manufacturing, customer service, transportation, and data entry have already witnessed significant changes due to automation. This displacement can lead to job losses and a shift in the required skill sets for the workforce.

-Job Transformation: While some jobs may be replaced by AI, new job opportunities are also created. AI technologies require skilled professionals to develop, implement, and maintain them. The demand for AI engineers, data scientists, machine learning experts, and other specialized roles has increased. Moreover, AI can augment human capabilities, leading to the creation of new job roles that focus on collaboration with AI systems.

-Skill Upgradation and Reskilling: The rise of AI and digitalization necessitates a shift in the skills demanded by the job market. As certain jobs become automated, it becomes crucial for individuals to acquire new skills or upgrade existing ones to remain employable. Lifelong learning and continuous skill development become essential to adapt to the changing job landscape.

-Job Creation and Economic Growth: While there are concerns about job displacement, AI and digitalization also have the potential to create new industries and job opportunities. Emerging sectors such as AI development, robotics,

cybersecurity, and big data analytics offer promising career prospects. Moreover, increased productivity and efficiency resulting from AI implementation can drive economic growth, leading to the creation of additional jobs in other sectors.

-Human-AI Collaboration: Rather than viewing AI as a direct substitute for human labor, a more optimistic perspective is to see it as a tool for collaboration. AI can assist humans in decision-making, automate routine tasks, and provide valuable insights based on data analysis. This collaboration between humans and AI can lead to increased productivity, improved outcomes, and the development of new products and services.

-Societal Impact and Policy Considerations: The impact of AI and digitalization on employment extends beyond the individual level and has broader societal implications. It is important for governments, policymakers, and organizations to anticipate and address the potential challenges associated with job displacement. Initiatives such as reskilling programs, social safety nets, and policies promoting responsible AI deployment can help mitigate negative consequences and ensure a smooth transition to the digital age.

In recent years, the rapid development of artificial intelligence has become the core driving force leading a new round of technological revolution and industrial transformation, comprehensively and profoundly changing human production and lifestyle. my country attaches great importance to the development of artificial intelligence and has elevated artificial intelligence to a national strategy. The report of the Nineteenth National Congress of the Communist Party of China proposed to "promote the deep integration of the Internet, big data, artificial intelligence and the real economy". In July 2017, the State Council issued the "New Generation Artificial Intelligence Development Plan", which clearly stated that "by 2030, the theory, technology and application of artificial intelligence will reach the world's leading level in general and become the world's main artificial intelligence innovation center", and requires "focus on impact on employment". At present, as one of the seven major fields of "new infrastructure", the deep integration of artificial intelligence and traditional industries has not only promoted the upgrading of industrial intelligence, but also opened up new employment space.

Generally speaking, the development and application of artificial intelligence technology has restructured all aspects of social reproduction, and has a wide range of impact on the employment field, fast speed, and great impact.

First, profound adjustments have taken place in the employment structure. Intelligent machines are faster, more efficient, and more accurate in repetitive, regular, and programmable tasks, and can replace not only physical labor, but also most of the mental labor. With the development of artificial intelligence, a large number of occupations such as translators, shopping guides, drivers, and accountants may be replaced. At the same time, many new jobs were created, promoting the development of higher-quality employment. In the past two years, the Ministry of Human Resources and Social Security, the State Administration for Market Regulation and the National Bureau of Statistics jointly released three batches of 38 new occupations. These new occupations are mainly concentrated in high-tech

fields, emerging industries and modern service industries, such as artificial intelligence engineers and technicians, and digital managers. Therefore, the development of artificial intelligence has brought about the in-depth adjustment of the industrial structure, occupational structure, and knowledge structure of employment. of jobs move to creative, higher-value jobs.

Second, new forms of employment are booming. The new employment form refers to the realization of a new employment model that is different from the traditional employment field, employment technology, and employment organization relying on modern information technology means such as the Internet, artificial intelligence, and big data. In recent years, a large number of high-end new occupations have emerged in the high-tech field, such as artificial intelligence trainers. This type of new occupation is knowledge-intensive and technology-intensive employment. It has a large demand for professional and interdisciplinary talents, and its salary is relatively high. It has become a typical representative of high-quality employment. In addition, new forms of employment emerging on the basis of the Internet platform continue to grow and develop, such as online order delivery staff. This type of new employment form is labor-intensive employment, featuring large employment capacity, low entry and exit barriers, non-standardized labor relations, and Internet-based entrepreneurial opportunities, and has become an important channel for employment.

Third, the requirements for vocational skills and employability have been greatly increased. Currently, talents with skills such as artificial intelligence, machine learning, and data science are highly sought after in the workplace. However, artificial intelligence is still in the stage of weak artificial intelligence. It does not yet have self-awareness, and can only execute established procedures to complete work tasks. Therefore, a large number of innovative talents will be needed in the future. In 2019, the World Bank released the "World Development Report: The Transformation of the Nature of Work", pointing out that advanced cognitive skills (such as the ability to solve complex problems), social behavioral skills (such as the ability to work in teams), and skills combinations that can predict and adapt ((e.g. reasoning skills, self-efficacy) are gaining in importance in the labor market. These skills are both uniquely human abilities and human capital for more valuable work.

In view of this, we should adhere to the principle of human beings controlling artificial intelligence, speed up the formulation of forward-looking policies and regulations, scientifically respond to the opportunities and challenges brought by artificial intelligence, and strive to create a win-win situation for the development of artificial intelligence and high-quality employment.

First, using AI to promote decent work. Artificial intelligence technology innovation is not a goal in itself, but a tool and means to improve productivity, expand human capabilities, and enhance human well-being. Therefore, we should use artificial intelligence to promote decent work and ensure that all workers work in conditions of freedom, justice, safety and dignity. First of all, give full play to the advantages of artificial intelligence and replace human beings in simple, repetitive,

arduous, dangerous and even alienated livelihood work, so that human beings can have more time and energy to engage in creative and humanistic labor. Second, use artificial intelligence technology to improve working conditions, such as assisting labor management and identifying high-risk industries. Third, reduce work stress and potential occupational injuries through human-machine collaboration.

Second, accelerate the training of high-end artificial intelligence talents. In the era of artificial intelligence, to achieve higher quality and fuller employment, talents are the support, and artificial intelligence education is the key. First of all, do a good job in artificial intelligence higher education and accelerate the training of high-end talents in artificial intelligence. At present, high-end talents are the key to the development of artificial intelligence and the focus of competition. Colleges and universities should improve the discipline layout in the field of artificial intelligence as soon as possible, and explore a new model of deeply integrated discipline construction and talent training. At the same time, build a training system that pays equal attention to basic theoretical talents and "artificial intelligence + X" compound talents, and promote a new training model of industry-university-research cooperation. Secondly, carry out basic education in artificial intelligence and cultivate innovative talents in the era of intelligence. The state should provide an overall solution for artificial intelligence education at different stages from kindergarten to high school, set up artificial intelligence-related courses in primary and secondary schools, and gradually promote programming education. Thirdly, use artificial intelligence technology to innovate education methods. Build a new education system that includes intelligent learning and interactive learning, and promote lifelong, fair, and personalized education. Establish a student-centered educational environment, promote the transformation of school responsibility from knowledge education to wisdom education, and cultivate students' innovative ability and cooperative spirit.

Third, improve the technology application level and employability of workers. At present, the employment structural contradiction that the skill level of workers does not match the job demand is becoming more and more prominent. Therefore, lifelong vocational skills training should be carried out on a large scale for all kinds of laborers in urban and rural areas to build a knowledge-based, skilled and innovative workforce. Promote the promotion and migration of new job skills through training to meet the needs of high-skilled and high-quality jobs brought about by the development of artificial intelligence in my country.

Fourth, explore the establishment of a universal labor security system. With the development of new employment forms, a large number of non-standard labor relations have increased rapidly, while the current labor security system is designed on the basis of standard labor relations, and there is a certain degree of absence in the protection of the labor rights and interests of platform-based employees. Therefore, it is recommended that the country gradually explore the establishment of a universal labor security system, set a labor security bottom line for all workers, and promote new employment forms to achieve high-quality employment while expanding employment.

In today's digital age, the Internet and digital technologies are developing rapidly and covering a wide range of fields. In order to adapt to the changes of this era, it is becoming more and more important to continuously learn new skills and knowledge. Here are a few tech fields that are good places to study and have good job prospects.

Artificial Intelligence (AI) and Machine Learning (ML)

With the increase in the amount of data and the improvement of computing power, artificial intelligence (AI) and machine learning (ML) technologies are more and more widely used in various industries, including medical care, finance, manufacturing, etc. Learning these skills can lead to high-paying job opportunities.

Data Analytics and Data Science

Data analysis and data science refer to the analysis and mining of large amounts of data to discover the laws and trends behind the data and provide decision support for enterprises. Data analysis and data science have become necessary skills for major enterprises and institutions, so there is a high demand for talents who are proficient in data analysis and data science.

Front-end development and mobile application development

With the popularization of the Internet and the wide application of mobile devices, the demand for front-end development and mobile application development is also increasing. Learning front-end development and mobile application development can help you become a technical professional and gain employment in a variety of industries.

Cloud Computing and Big Data Technology

Cloud computing and big data technologies are essential technologies for digital transformation of today's enterprises. By learning cloud computing and big data technology, the data storage and processing of enterprises can be made more efficient, while improving the security and reliability of enterprises.

blockchain technology

Blockchain technology has become a popular technology in fields such as digital currency, finance, supply chain management and the Internet of Things. Learning blockchain technology can open you up to employment opportunities in these fields.

In general, learning technology is not just to find a good job, but also to improve one's skills and competitiveness, so that one can better adapt to the changes in this digital age.

In summary, the rise of AI and digitalization has transformed the employment landscape. While certain jobs may be automated, new opportunities arise, requiring individuals to adapt and acquire new skills. Collaboration between humans and AI can lead to increased productivity, economic growth, and the development of innovative solutions. By proactively addressing the challenges and opportunities associated with AI, we can navigate the age of digitalization in a way that benefits both individuals and society as a whole.

Artificial Intelligence (AI) has a significant impact on the employment market and is transforming the nature of work in various ways. Here are some perspectives on how AI is affecting the employment market:

Job Automation: AI technology is automating repetitive and routine tasks across various industries. This automation can lead to the displacement of certain job roles, particularly those that involve manual and repetitive work. Jobs in manufacturing, transportation, data entry, and customer service, among others, are being automated, potentially leading to job losses in these areas.

New Job Creation: While AI may eliminate certain job roles, it also creates new opportunities. As AI technology advances, new jobs are emerging that require skills in developing, implementing, and maintaining AI systems. These roles include AI engineers, data scientists, machine learning specialists, and AI ethicists. Additionally, there is an increasing demand for workers who can collaborate effectively with AI systems or work alongside them.

Skill Shift: The rise of AI is driving a shift in the skills required in the job market. Some routine and repetitive tasks are being automated, placing a higher premium on skills that are uniquely human, such as critical thinking, creativity, emotional intelligence, complex problem-solving, and adaptability. Workers need to develop a combination of technical skills and soft skills to remain competitive in the job market.

Augmented Intelligence: AI is not just about replacing humans; it also has the potential to augment human capabilities. By leveraging AI tools and technologies, workers can enhance their productivity and decision-making abilities. AI can assist with data analysis, provide insights, automate administrative tasks, and offer personalized recommendations, enabling workers to focus on more complex and value-added work.

Workforce Restructuring: The introduction of AI in the workplace may lead to the restructuring of job roles and the redistribution of tasks between humans and machines. Some tasks will be automated, while others will require human intervention. This restructuring may necessitate reskilling or upskilling of the existing workforce to adapt to new roles and responsibilities.

Ethical Considerations: As AI becomes more pervasive in the employment market, ethical considerations surrounding its use become crucial. Issues such as privacy, bias, transparency, and accountability need to be addressed to ensure responsible and fair AI deployment. Ethical frameworks and regulations will likely evolve to govern the development and use of AI systems in the workplace.

In summary, AI is reshaping the employment market by automating certain tasks, creating new job opportunities, emphasizing specific skills, augmenting human capabilities, restructuring workforces, and requiring ethical considerations. While AI may displace certain job roles, it also presents opportunities for innovation, productivity gains, and the evolution of work in the future.

Proponents of the pessimistic scenario [4, 5], assessing the marginal impact of the development of the use of AI on labor productivity, predict mass unemployment, poverty and worsening social tension. In their opinion, integration technical Cyber physical systems will lead to significant savings in labor costs and the dying out of traditional professions, the cycles of which will be reduced to 3–5 years. As only for

an algorithm will be created for the new specialty, and its implementation will go to work.

It's important to note that the scenarios described above are speculative, and the actual impact of AI on the employment market will depend on various factors such as technological advancements, societal acceptance, economic conditions, and policy decisions. While some jobs may be at risk, AI also has the potential to create new opportunities and enhance human productivity and capabilities.

Global labor market embraces new age technology and artificial intelligence expected to drive nearly a quarter of workers to change jobs
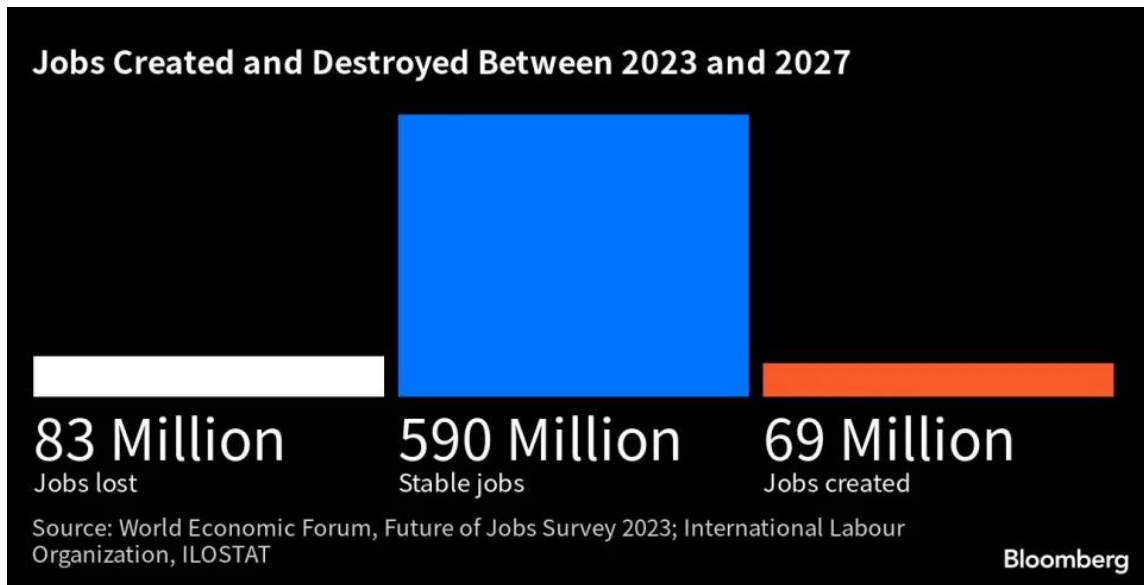
The global labor market is about to usher in a new era of turmoil as technologies such as artificial intelligence accelerate the decline of paperwork while increasing demand for technology and cybersecurity experts.

According to a report released by the World Economic Forum in Geneva on Monday, nearly a quarter of job opportunities will be transformed by artificial intelligence, digitalization and other economic developments such as green energy transition and supply chain reconstruction in the next five years.

While the study expects AI to cause "significant labor market disruption," the net impact of most technologies will be positive over the next five years, with big data analytics, management technology and cybersecurity emerging as the biggest drivers of job growth.

The emergence of AI applications such as ChatGPT, which uses machines to simulate human reasoning and problem solving, will have a particularly dramatic impact by replacing and automating many roles involved in reasoning, communication and coordination, the report said.

Some 75 percent of companies surveyed said they expect to adopt AI technologies over the next five years, and expect these technologies to eliminate as many as 26 million jobs in record-keeping and administrative positions. The World Economic Forum study surveyed more than 800 companies in 45 economies around the world, employing 11.3 million people.

For now, AI poses less of a threat to the workforce outlook than other macroeconomic factors such as slowing economic growth, supply shortages and inflation, the report said. Jobs could come from investments that promote green transformation of companies, wider application of ESG standards and reorientation of global supply chains.

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9. SMART TOURISM IN A SMART CITY SYSTEM: HOW INNOVATIONS TRANSFORM THE TOURISM INDUSTRY?

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In today's world, innovative technologies are actively transforming various spheres of human life, changing approaches to organization and interaction. Tourism is an area that is experiencing significant impact and realizing its potential through innovation. In connection with the rapid development of cities and all kinds of technologies, a new approach to the development of the tourism industry has appeared – smart tourism. And when this approach is combined with innovative concepts of smart cities, a unique opportunity opens up to create a new, more efficient and sustainable tourism environment.

Smart tourism in a smart city system is a new stage in the tourism industry development, where modern innovative technologies and concepts of the "smart city" are combined with the aim of providing tourists with an unparalleled experience and optimizing the management of tourist resources. With the help of information technologies, mobile applications, artificial intelligence and other innovative solutions, smart tourism sets itself the task of not only meeting the needs of tourists, but also ensuring the sustainability and efficient use of city resources.

This article examines the key aspects of smart tourism in the context of a smart city, focusing on the advantages, disadvantages and challenges facing this innovative concept. Let's explore examples of the smart tourism implementation and get acquainted with innovative technologies that transform the tourism industry and make cities attractive to visitors. Smart tourism is a new reality that requires changes in ways of thinking and doing, and opens up many opportunities for improving the quality of the tourist experience and the balanced development of cities.

Unlike traditional forms and types of tourism, smart tourism does not yet have clear standards and definitions. This makes it difficult to conduct systematic research and comparison of results. However, scientific research in the field of smart tourism is gradually increasing. We can single out the scientific works of such scientists as O. Liubitseva, N. Belousova and O. Skorostetska [1] (identified the peculiarities of the tourist destination formation as an element of a smart city), T. Tymoshenko [2] (considered the concept of smart tourism management within the framework of the implementation of sustainable strategies development of territorial communities), I. Yashchyshina [3] (defined the essence of the concept of smart tourism, analyzed the

world experience and domestic practice of implementing the concept of smart tourism), L. Nokhrina and N. Berdin [4] (analyzed the socio-economic aspect of the smart tourism development). Foreign scientists F. Ercan [5], C. Madeira, P. Rodrigues, M. Gomez-Suarez [6], E. Díaz, A. Esteban, C. Koutra, S. Almeida, R. Carranza [7] reviewed the articles published in scientific journals, on the subject of smart tourism research using the technique of bibliometric analysis.

We can conclude that smart tourism is little researched by scientists, especially compared to traditional tourism. The concept of smart tourism has emerged in recent decades and is to some extent a reaction to the growth of traditional mass tourism. Other forms of tourism, such as ecological and sustainable tourism, have already been explored, but smart tourism has its own unique features that require a separate study.

Smart tourism is a concept that combines tourism and modern technology to improve the tourist experience, efficiency and sustainability of the tourism industry. This concept is based on the use of innovative technologies such as Internet of Things (IoT), artificial intelligence (AI), virtual reality (VR), blockchain, data analytics and others to provide more comfortable, convenient, secure and personalized tourism and hospitality services.

The term "smart tourism" can have different interpretations depending on the context and scope of application. Here are some basic approaches to the interpretation of smart tourism [8-10]:

1. Technological approach focuses on the use of innovative technologies, such as artificial intelligence, virtual reality, blockchain, Internet of Things, etc., to improve the tourist experience, optimize tourism management processes and ensure greater sustainability and efficiency of the tourism industry.

2. Socio-economic approach emphasizes the social and economic impact of smart tourism on local communities, tourism regions and the economy in general. It focuses on sustainable development, promotion of socio-economic development of local residents and preservation of cultural heritage.

3. Ecological approach is focused on the ecological aspects of smart tourism, such as conservation of natural resources, reduction of carbon footprint, green tourism and other practices aimed at preserving the environment.

4. Interactive approach emphasizes the involvement of tourists in active participation in the creation and maintenance of tourist infrastructure, sharing experiences and feedback about travel, as well as cooperation with local residents for the development of tourism.

In general, smart tourism can be seen as an integrative concept that brings together technology, sustainability, cultural and environmental aspects to create an improved, sustainable and efficient tourism experience for all stakeholders.

The main aspects of smart tourism include [3; 10; 11]:

1. Optimizing the travel experience – using technology to improve travel planning, booking and payment processes, as well as providing personalized recommendations and programs for tourists.

2. Ensuring safety – using technologies to improve tourist safety, monitor risks, identify hazards and ensure rapid response to unforeseen situations.

3. Sustainability and environmental care – implementation of smart technologies to reduce the negative impact of tourism on the environment, support environmentally friendly alternatives and sustainable development of tourist regions.

4. Crowdsourcing and social impact – engaging the public to actively participate in the creation and improvement of tourism infrastructure, data collection and information sharing through interactive platforms.

5. Development of innovative tourist products – promoting the creation of new tourist offers and services based on the use of advanced technologies that attract more tourists.

In general, smart tourism is aimed at improving the efficiency, convenience and quality of the tourist experience, as well as ensuring the sustainable development of the tourism industry and the preservation of natural and cultural resources. A smart city (sometimes also called an "intelligent city") is a city that uses information technology and data collection and analysis tools to effectively manage various aspects of city life, provide comfort and convenience for residents, and improve the quality of life. The goal of smart cities is to create sustainable, efficient and comfortable urban environments for their residents, which contributes to the improvement of the quality of life and stimulates economic development.

"Smart city" and "smart tourism" are concepts that interact and can coexist, but they have different emphasis and direction. Smart cities work on the use of information technologies and innovative solutions to ensure efficient management of city resources and services. One area where smart cities can implement solutions is smart tourism. Smart cities can leverage technology and innovation to improve the tourism experience for visitors. For example, the use of mobile applications, interactive maps, QR codes or other technologies can help tourists access information about popular tourist destinations, city history, cultural activities and events. Tourism plays an important role in the development of a smart city, especially in the context of sustainable development and economic growth. Smart cities can consider smart tourism as a way to attract tourists, create new jobs, develop innovative tourism products and improve travel infrastructure.

Smart tourism uses technological innovation to improve the tourist experience. In smart cities, technological solutions can be more widely implemented and accessible to tourists, allowing them to receive personalized recommendations, access to digital maps and navigation systems, convenient access to public transport and other benefits. Smart cities can use technology to improve the safety and comfort of tourists. For example, video surveillance systems, air pollution sensors, tourist-friendly information panels help ensure safety and convenience for the tourist experience.

A smart city can contribute to the development of tourism, and smart tourism, in turn, can make a positive contribution to the development of the city. Improving tourism infrastructure, increasing tourist flows and increasing tourist satisfaction can

generate revenue for a city and help increase its attractiveness for both tourists and residents.

A smart city and smart tourism are interrelated, and their coexistence can help ensure sustainable development, improve the quality of life for residents, and increase the city's attractiveness for both tourists and businesses. The concepts of "smart city" and "smart tourism" have some common features, as they both refer to the use of technology and innovation to improve people's lives. However, they also have their differences, which allow them to be considered as separate, but interconnected concepts (Table 1).

Table 1

Comparative characteristics of a smart city and smart tourism

Criteria	Smart city	Smart tourism
Common		
Technological aspect	They are based on the use of modern information technologies, such as artificial intelligence, Internet of Things, big data, virtual reality, data analytics, and others, for data collection, analysis, and information processing.	
Improving the quality of life	Aimed at creating a convenient and comfortable environment for residents and tourists, ensuring efficient use of resources and improving the quality and safety of life.	
Sustainability and environmental care	Include aspects of sustainability, energy efficiency and environmental protection, as these are important priorities in today's world.	
Effective management	Strive for efficient management of resources, services and infrastructure to provide a better experience for residents and tourists.	
Differences		
Sphere of use	Covers the management and optimization of various aspects of citizens' lives in a broad context, including infrastructure, energy, transportation, education, health and other areas.	Focused on improving the tourist experience, hospitality services, attracting tourists and developing the tourism industry.
Target audience	Aimed at meeting the needs of residents and managing the city as a whole.	It mainly concerns tourists and the tourism industry.
Geographical aspect	It is applied to the management of cities and megacities.	Focused on tourist destinations, resorts, national parks and other tourist facilities.

Source: compiled by the author

In general, smart city and smart tourism are related concepts that can complement each other and contribute to the sustainable development of cities and the improvement of the quality of life of residents and visitors.

Smart tourism uses a variety of innovative technologies to improve the tourist experience, ensure safety and efficiency of services. The characteristics of some of the most common innovative technologies in the smart tourism management are presented in Table 2.

Table 2

Characteristics and directions of using innovative technologies in the smart tourism management

Innovative technologies	Characteristic	Examples
Mobile applications	Provide tourists with convenient access to information about tourist attractions, events, restaurants, hotels, transport schedules, etc. Applications may also contain map services and GPS for navigation in city facilities.	Mobile applications for [12]: – searching for air tickets: Aviasales, Skyscanner; – booking hotels and apartments: Booking.com, Airbnb, Couchsurfing; – cards: Maps.me, Google Maps; – searching for establishments: TripAdvisor, AroundMe; – translators: Google Translate, Scanner & Translator; – movement: BlaBlaCar, Uber.
Internet of Things (IoT)	IoT uses sensors and devices to collect data and interact with the environment. IoT can be used to collect environmental data such as temperature, humidity, number of tourists, helping to optimize the tourist experience and resource management [13].	The "Smart Home" management system, which provides the possibility of centralized hotel management [14].
Virtual Reality (VR) and Augmented Reality (AR)	Create an immersive travel experience, allowing tourists to visit remote places or see historical events in the form of 3D models. AR can help to use additional information about tourist attractions using smartphones or special devices.	Open air virtual tour of museums of Ukraine [15]; the Tustan AR application, which uses augmented reality technology to look at the appearance of the Tustan rock fortress of the IX-XIII centuries. [16].
Artificial Intelligence (AI)	It is used to analyze data and provide personalized recommendations to tourists, provide chatbots for fast customer support and automate booking and payment processes.	Chatbot from the tourist portal VisitUkraine.Today in Telegram for those who are planning their trip to Ukraine, as well as for Ukrainians who are going to visit foreign countries [17].
Blockchain	Provides security and authentication for tourism transactions such as hotel reservations, transport tickets or event tickets. Helps solve identification and document management problems while traveling.	Beenest is a blockchain-based open-source decentralized housing platform that utilizes the Bee Token. Beenest is a short-term housing rental platform for Hosts to list their homes and for Guests to find accommodations [18].
Data analytics	Enables tourism organizations to understand the behavior and demand of tourists, which helps solution manufacturers to optimize their offer and services.	Kyivstar mobile communications operator offers to build a portrait of a client visiting a tourist destination, based on the analysis of big data (almost 26 million subscribers) [19].
Crowdsourcing and social media	Allow the public to be involved in contributing ideas, posting reviews and supporting local tourist	Amazon Mechanical Turk (MTurk) is a crowdsourcing marketplace that makes it easier for individuals and

		attractions.	businesses to outsource their processes and jobs to a distributed workforce who can perform these tasks virtually [20].

Source: compiled by the author

These technologies not only improve the tourist experience, but also contribute to the sustainable development of the tourism industry, effective management and attraction of more tourists to different areas.

The implementation of smart tourism has numerous benefits for the tourism industry, cities and residents. Here are some of them [21-23]:

1. Improved tourist experience. Smart tourism provides tourists with a personalized and interactive experience. The use of modern technologies, such as mobile applications, AR and VR, allows for convenient access to information about tourist objects and services, creating interactive tourist cards and tours, which make trips more exciting and memorable.

2. Increase in tourist flow. Smart tourism helps attract more tourists to cities and regions. Effective tourism marketing strategies, the use of social networks and other innovations contribute to increasing the popularity of local attractions and services, thereby increasing the tourist flow.

3. Increase in income. Increased tourist traffic and an improved tourist experience can lead to increased revenues in the tourism industry and related industries such as hospitality, restaurant business and retail.

4. Investment attraction. The development of smart tourism can attract investment in tourism projects and infrastructure. Innovative technologies and approaches become attractive to investors, which helps develop tourism resources and improve the city's tourism product.

5. Effective management of resources. Smart tourism allows you to effectively manage resources such as energy, water, transport and others, ensuring the optimization of tourism infrastructure and reducing the negative impact on the environment.

6. Improving the quality of life of residents. The development of smart tourism can positively affect the quality of life of residents. The provision of convenient and modern tourism services is also beneficial for local residents, as it contributes to the improvement of infrastructure and the comfort of their daily lives.

7. Sustainability and preservation of cultural heritage. Smart tourism contributes to sustainable development and preservation of cultural heritage. Technologies can be used for eco-tourism, attracting attention to cultural traditions and attractions, as well as reducing the impact of tourism on nature.

Despite the many benefits, the implementation of smart tourism also faces some barriers and challenges. Here are some of them:

1. Technological barriers. Implementation of smart tourism requires significant investment in technology and infrastructure. For some smaller cities and regions, it may be difficult to find enough resources to implement modern technologies.

2. Data security and privacy. The use of many technologies in smart tourism, such as mobile applications and online platforms, requires the collection and processing of personal data. This can create data security and privacy issues if appropriate measures are not taken to protect it.

3. Dependence on technologies. Smart tourism can become too dependent on technology, and if something goes wrong with the systems, it can lead to disruptions and tourist dissatisfaction.

4. Negative impact on the local environment. The use of technology and increased tourist traffic can have a negative impact on nature and cultural sites. If measures are not taken to sustainably manage and conserve natural and cultural resources, this can lead to degradation and pollution.

5. Conflicts between tourists and residents. The increase in tourist traffic and the use of technology can cause conflicts between tourists and residents, especially in places with a high tourist load.

The development of smart tourism is an important direction for improving the tourist experience, increasing the competitiveness of tourist destinations and promoting the sustainable development of the industry. Here are some recommendations for the further development of smart tourism in the management system of smart cities:

1. Accelerated adoption of information technologies such as mobile applications, artificial intelligence, blockchain, Internet of Things (IoT) and data analytics allows for a more convenient, personalized and efficient travel experience.

2. It is important to develop infrastructure that supports smart tourism. This includes developing safe and convenient mobile applications, improving Wi-Fi access, and creating interactive information points located at popular tourist destinations.

3. Applying technology to personalize marketing strategies helps attract tourists with a higher level of interest and creates more effective marketing campaigns to promote tourism services and destinations.

4. Linking to crowdsourcing and public engagement helps create a more engaged and engaged public experience, increases tourist satisfaction and promotes new ideas and initiatives.

5. Support for sustainable development. Smart tourism can contribute to sustainable development as it helps to reduce the negative impact on the environment and promotes the development of sustainable tourism infrastructure.

6. Promote the development of new innovative services and technologies that provide a unique and interesting tourist experience, such as virtual tours, augmented reality in tourism, quest games and others.

7. Cooperation between sectors. The development of smart tourism requires cooperation between different sectors, including tourism, technology, transport, local authorities and other stakeholders.

8. Ensuring security and data protection. The development of smart tourism should be accompanied by measures to protect personal data and ensure cyber security.

With these recommendations in mind, tourism industries and local governments can create innovative and increasingly smart tourism experiences for tourists and promote the development of tourism destinations.

Innovative technologies have a significant impact on the development of the tourism industry and contribute to the introduction of smart tourism in the smart city system. The use of modern information technologies, such as mobile applications, Internet of Things, big data, artificial intelligence, virtual and augmented reality, blockchain and others, allows to provide a personalized, convenient and efficient tourist experience for visitors. Cooperation between various stakeholders, such as tourism organizations, local authorities, public organizations and the private sector is necessary for the effective implementation of smart tourism. This makes it possible to create a comprehensive and effective smart tourism infrastructure and maximize its positive impact on the industry and the city as a whole.

Smart tourism is a promising direction in the development of the tourism industry, which uses innovative technologies to improve the tourist experience, attract more tourists and optimize resource management. The implementation of smart tourism has a number of benefits, such as improved tourist experience, increased income, sustainability and preservation of cultural heritage.

However, the implementation of smart tourism is also associated with shortcomings and challenges. The digital divide and technological barriers can make it difficult for some segments of the population and local communities to access innovation. Ensuring the security and protection of data privacy are also becoming important challenges. Successful implementation of smart tourism requires collaboration between various stakeholders, including tourism organizations, local authorities, community organizations and the private sector. It is important to ensure the sustainability of the development and management of tourist resources, the involvement of residents in the decision-making process, and the preservation of the authenticity of cultural and natural resources.

Smart tourism is a key element for the development of smart cities, where technologies are used not only to provide convenience and personalize the tourist experience, but also to optimize resource management, improve the quality of life of residents and preserve natural and cultural values. Innovative technologies are transforming the tourism industry into smart tourism, which aims to provide a more convenient, personalized and sustainable tourism experience for visitors in the context of a smart city. The integration of innovative technologies with well-organized and cooperative structures of a smart city allows to optimize the tourism potential of the city, ensure its sustainability and attractiveness for visitors, as well as improve the quality of life of residents.

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10. RESEARCH OF SOURCES, FACTORS AND METHODS OF EFFICIENCY OF USE OF INTELLECTUAL PROPERTY OBJECTS

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Intellectual property (IP) objects arise as a result of creative and inventive activity of people. Due to the significant amount of specificity of these results, it is quite difficult to find directions and methods for developers (copyright holders) to obtain real material benefits from them.

At this time, the theory and practice of economic efficiency recommends a sufficient number of methods of recommendations for assessing the effectiveness of innovation and investment activities of industrial enterprises. However, they are not fully suited to evaluate the effectiveness of intelligent products. This is because in creation and use intellectual property objects are attended by significantly more participants in comparison, for example, with an investment project. Investors, research, development, design organizations, factories-producers of new products and its consumers take part in the intellectual and innovative process. In the implementation of the investment project interested investors who finance it, and enterprises involved in the implementation of the project [1, p.435].

Also, important is period, within which costs are incurred and revenues are received due to the creation, production and operation of IP objects, in many cases takes a much longer period of time than the corresponding period of implementation of a conventional innovative project. To a large extent, this is typical for new machines, design materials, agricultural machinery, etc. Along with this, the market implementation of IP objects (commercialization) has the ultimate goal of achieving better results compared to its counterpart. In the existing methodological recommendations [2, 3, 4], this issue is not given due attention.

In addition, for fundamentally new products created using IP objects, should find appropriate recognition from the consumer, while the price of products, the release of which is provided for by an investment or innovation project, has already received its confirmation in the market. Achieving the final result of the innovation process is associated with higher risks compared to the implementation of the investment project.

The influence of these factors determines the peculiarities of determining the economic efficiency of intellectual products and detailed research and scientific analysis of the existing methodological framework for assessing the economic efficiency of intellectual property.

The problem of economic evaluation of the processes of creation and consumption of intellectual property in industrial enterprises has long been in the focus of attention of many theorists and practitioners. These questions are outlined in a scientific publication, a textbook ah and a textbook ah, published by the authors of recognized scientists Zakharchenko N.V. [1], O.B. Butnik-Siversky [2], Gy.Kocziszky [3], S.M. Illiashenko [4], T.O.Kobeleva [5, 6], A.V. Kosenko [7], O.P. Kosenko [8], S.Nagy [9], P.G. Pererva [10, 11], Marchuk L.S. [12], Starostina A.O. [13], V.V. Virchenko [14], I.V.Silka [15] and others. In general, these researchers consider the effectiveness of business entities using either a structural approach, based on – modernization of the organizational form of management of intellectual and innovative activity at an industrial enterprise, or the technological approach, which involves consideration of the content of analytical work at various technological stages of information processing.

Scientific publications raise the problems of evaluating the effectiveness of IP in an industrial enterprise in various directions. In particular, the issues of detailing the components and distribution of volumes of analytical work between officials at each organizational stage of the analysis: preparatory, main and final [2, 4] are investigated. Various organizational structures of IP management are proposed with the inclusion of such a functional block as the intellectual property department [11, p. 19-20]. Also, the publications address the issues of determining a stable regular relationship between IP management and the organizational form of the enterprise [5, 10], investigate the issues of organizing IP monitoring [3, 13, 14]. It should be noted the increased interest of scientists in various fields of economic science to consider the design of effective organizational IP management systems in general [7, 8, 15].

A critical review of the specialized literature has shown that in modern systems of economic substantiation of managerial decisions of business entities in the field of intellectual property, along with the processes of forming the structure and technology of performing analytical procedures, it is necessary to take into account the functions performed by the organizational system of intellectual activity. Since in the organizational system of IP management of modern domestic enterprises, the functions of economic evaluation intelligent technologies are practically not considered, the issues of the effectiveness of the development and consumption of IP are of particular importance and require additional research.

The term "effect" is more inherent in business activities. It includes the possibility of obtaining real profit from business activities, the use or sale (monetization) of any object. With skillful disposal of property, you can monetize not only tangible objects, but also intangible ones, which are created as results of creative work.

The first step towards making a profit is to ensure the regime of legal protection of intellectual property. Depending on the industry to which the result of creative work belongs, securing rights for the creator may require a number of actions. For example, to certify the rights to an invention, utility model or industrial design (this is typical for industrial enterprises), it is necessary to file an application and then obtain

a patent confirming the authority of the owner and granting him exclusive rights to this object. Regarding the means of individualization (for example, a trademark), the "application" method is used, that is, the organization (person) that owns the trademark submits an application for its registration to the Ukrpatent.

It should be noted that ensuring reliable legal protection and intellectual product is the most important task for its developer (owner). The fulfillment of this task, firstly, ensures (confirms) the legal nature of the authority; secondly, the developer (owner) receives the exclusive (absolute) right to use the intellectual object; thirdly, it acquires the opportunity and ability to legally protect its exclusive rights interests in the event of illegal actions of offenders.

After registration and consolidation of exclusive rights, the developer (owner) should choose and justify ways that will allow effective (profitable) use of this object of intellectual property. The study of existing practice allows us to form and propose the five most important ways of effective use (monetization) of intellectual property (Fig. 1).
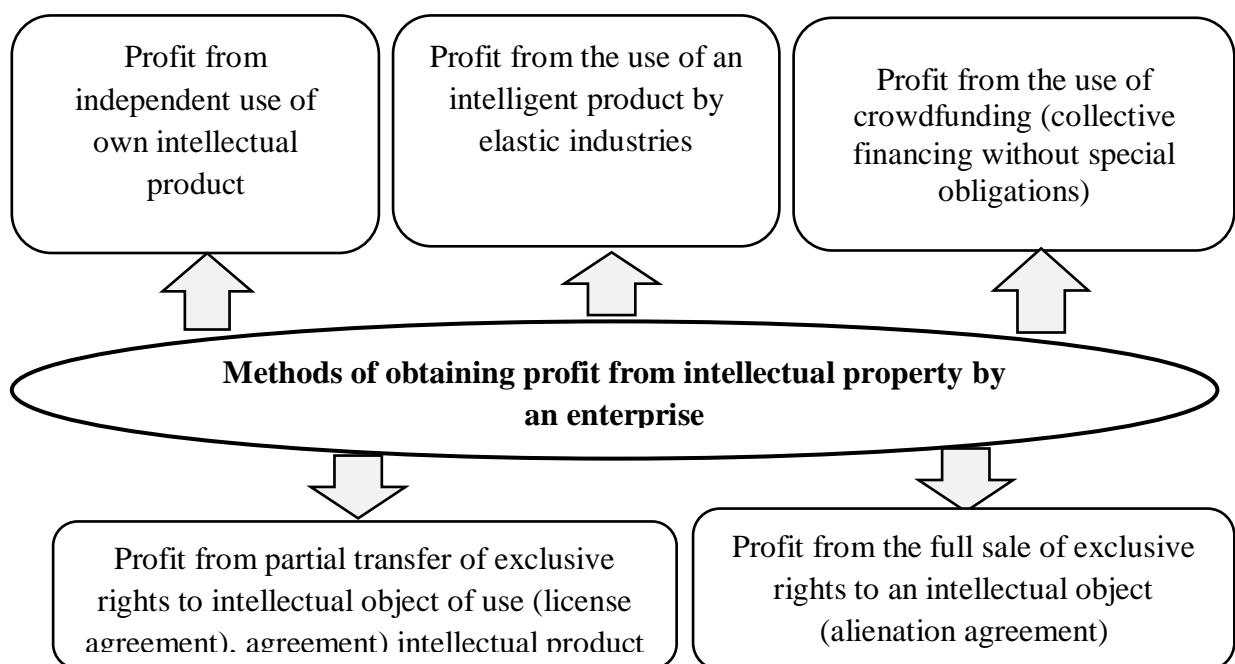

Figure 1 – Ways for the enterprise-copyright holder to receive profit (effect) from intellectual property

Source: Developed by the authors

The first way to make a profit and ensure the effectiveness of the use of intellectual property is associated with the independent use of one's own development, that is, making a profit as a result of complete undivided ownership. At the same time, the company independently uses and disposes of the result of its intellectual and innovative activity. The achievement of the effect (monetization) occurs due to the independent promotion and distribution by the enterprise-developer of products that are created using this intellectual technology and expressed in material form. For example, an inventor (employee of an enterprise) embodies a patented invention into an existing or new product, which is then distributed in the target market and brings additional profit to the enterprise. This method of making a

profit (effect) is one of the most common in the practice of innovation activity of industrial enterprises, but not always its use is obvious, since consumers of products are not always ready to consume improved or fundamentally new products of the enterprise, there is an urgent need to conduct a complex, and sometimes costly, marketing campaign.

Another way to make a profit is the benefit from production processes that take place in parallel with the use of intelligent technologies. The latest intelligent technologies can cause an indirect effect from the development of production, which is to some extent elastic to this production, where these intelligent technologies are used. For example, the development of intelligent energy technologies, cheaper electricity production will inevitably lead to a decrease in the cost of other goods that have nothing to do with energy intelligent products. At the same time, this kind of "elasticity", in our opinion, may require the payment of appropriate rent by producers of elastic goods to developers of intelligent energy technologies, increasing accordingly the efficiency of their use.

To some extent, the original non-traditional way to ensure the effectiveness of an intellectual product can be crowdfunding – collective financing of any project, that is, attracting material resources to finance an intellectual and innovative project, an industrial enterprise through contributions from many third parties and organizations that are not directly related to this project or its business investment. For the author of the project, these are not risky funds, since they are going to a charitable base from caring, inclined to a possible innovative project of organizations and individuals. A vivid example of crowdfunding is modern fundsfor the development and manufacture of Ukrainian drones to ensure victory over Russia.

The traditional and widely used method is to profit from the transfer of the exclusive right to use intellectual property by another enterprise. Most often, this procedure is accompanied by the preparation of a license agreement. The conclusion of license agreements is permissible for any intellectual property (with the exception of a number of means of individualization and production secrets). With regard to trademarks, the transfer of the right to use under a commercial concession agreement or franchise agreement is popular. In this case, the rights to the complex of intellectual property objects that together make up the company's brand are transferred. For example, according to information presented on the official website of McDonald's: "Currently, more than 80% of McDonald's enterprises around the world are owned and operated by independent local franchisee partners." At the same time, according to the ranking of the most expensive brands in the world in 2021 according to Forbes, McDonald's ranks 10th and the company's revenue reaches $96.1 billion. [16]

It is not uncommon to make a profit from the full transfer of intellectual property rights to another enterprise or person (the procedure for alienation of rights). The inhibitory moment of widespread use of this method is the fact that the copyright holder is deprived of all his rights to material (financial) claims regarding the intellectual object that previously belonged to him. These circumstances are often leveled by the amount of income from this operation. The cost of a full transfer of

rights under an alienation agreement is usually quite large and, in some cases, significantly exceeds the potential income that the developer planned to receive during a certain time of independent use of an intellectual object. The considered methods of making a profit (effect) from intellectual property indicate that the intellectual (intangible) assets of the enterprise have a very real, financial value and are able to bring a good effect to the patent owner.

Table 1 – Types of effects from the introduction into economic circulation of intellectual property and their characteristics

№	Type of possible effect	Characteristic of the effect
1.	Economic	In terms of value, it takes into account all results and costs caused by the creation and use of IP
2.	Market	Reproduces the qualitative improvement of innovative products manufactured using IP
3.	Scientific	Takes into account the expansion of theoretical knowledge, the development of various fields of scientific activity
4.	Scientific and technical	It is characterized by novelty, usefulness, simplicity, aesthetics, compactness of innovative products
5.	Commercial (financial)	Takes into account the financial implications for participants in the production and consumption process of the IP facility
6.	Resource	It is determined by the volume of consumption and production of various kinds of resources in the enterprise
7.	Technical	Reproduces the development of technology and technology
8.	Social	Takes into account the improvement of living standards and social preferences in the consumption of intellectual property
9.	Ecological	Takes into account the improvement of environmental performance and the consequences of production activities of the enterprise (noise, vibration, water, light, air, etc.).
10.	Legal	Characterizes the compliance of IP objects with current legislation (national and international)
11.	Marketing	Reproduces the timeliness of IP object development in terms of demand for relevant innovative developments
12.	Regional	Characterizes the improvement of factors and indicators of the regional economy
13.	Information	It is provided by the creation of new information on methods of meeting the needs, development of technology and economics
14.	Tax	Reproduces various kinds of tax state benefits in the field of innovative developments of the enterprise
15.	Synergistic	The complex impact of the IP object on various aspects of the enterprise and its stakeholders
16.	Ethnic and cultural	Evaluates the impact of intellectual products on the lifestyle of the population
17.	Negative	Reproduces possible negative consequences of IP object consumption, which manifest themselves in certain contradictions between business, the state and the environment

Source: Developed by the authors based on [1, 2, 11, 16]

Our study of possible options for introducing intellectual property objects developed at the enterprise into economic circulation shows that determining only the value of the economic effect does not always determine their advantages. Although the priority of this type of effect for an industrial enterprise is usually the greatest. As a possible effect of intellectual property, there may be other types of effects that are of less concern to developers of intellectual property in the case of their use in their own enterprise. In Table 6 we provide a list (in our opinion, far from complete) of the effects that can be obtained in a market economy when using intellectual property.

The use of considered and justified directions for obtaining a certain benefit from intellectual products developed at the enterprise or for which it is the copyright holder can lead to various kinds of effects, not always related to material benefits (Table 1).

Table 1 reproduces the multidimensionality of the intellectual and innovative activity of the enterprise, a diverse type of effects from the introduction of IP into economic circulation, which, although of different quality and value, are interrelated in their basis. There are certain difficulties in determining the exact quantitative assessment of certain types of effects, which determines the occurrence of certain problems in calculating the integral effect of IP. In addition, the economic evaluation of IP, in our opinion, should be carried out taking into account its life cycle, since each stage reproduces different types of effects, characterized by different target criteria. The multidimensionality of the intellectual and innovative activity of the enterprise is the reason that the economic evaluation of IP cannot be based on any one indicator, that is, the choice of the sphere and place of consumption of the IP object, the choice of the most effective of them is the task of vector-analytical optimization.

The use of considered and justified directions for obtaining a certain benefit from intellectual products developed at the enterprise or for which it is the copyright holder can lead to various kinds of effects, not always related to material benefits (Table 1).

At the same time, it does not make much sense to calculate, take into account and ensure all kinds of IP effects in the economic evaluation of their creation, distribution and consumption. But the main, most important of them must be calculated, analyzed and taken into account when carrying out intellectual and innovative activities in the enterprise. Of all the varieties of intellectual property effects, we propose to pay special attention to the five most important, which is reproduced by us in Fig. 2. Each of the basic effects of intellectual property is characterized by a certain set of indicators, the definition of which ultimately leads to the determination of the value of the effect itself. In table. Fig.2 presents a system of characteristic indicators of basic effects that can be obtained as a result of the creation and economic circulation of intellectual property.
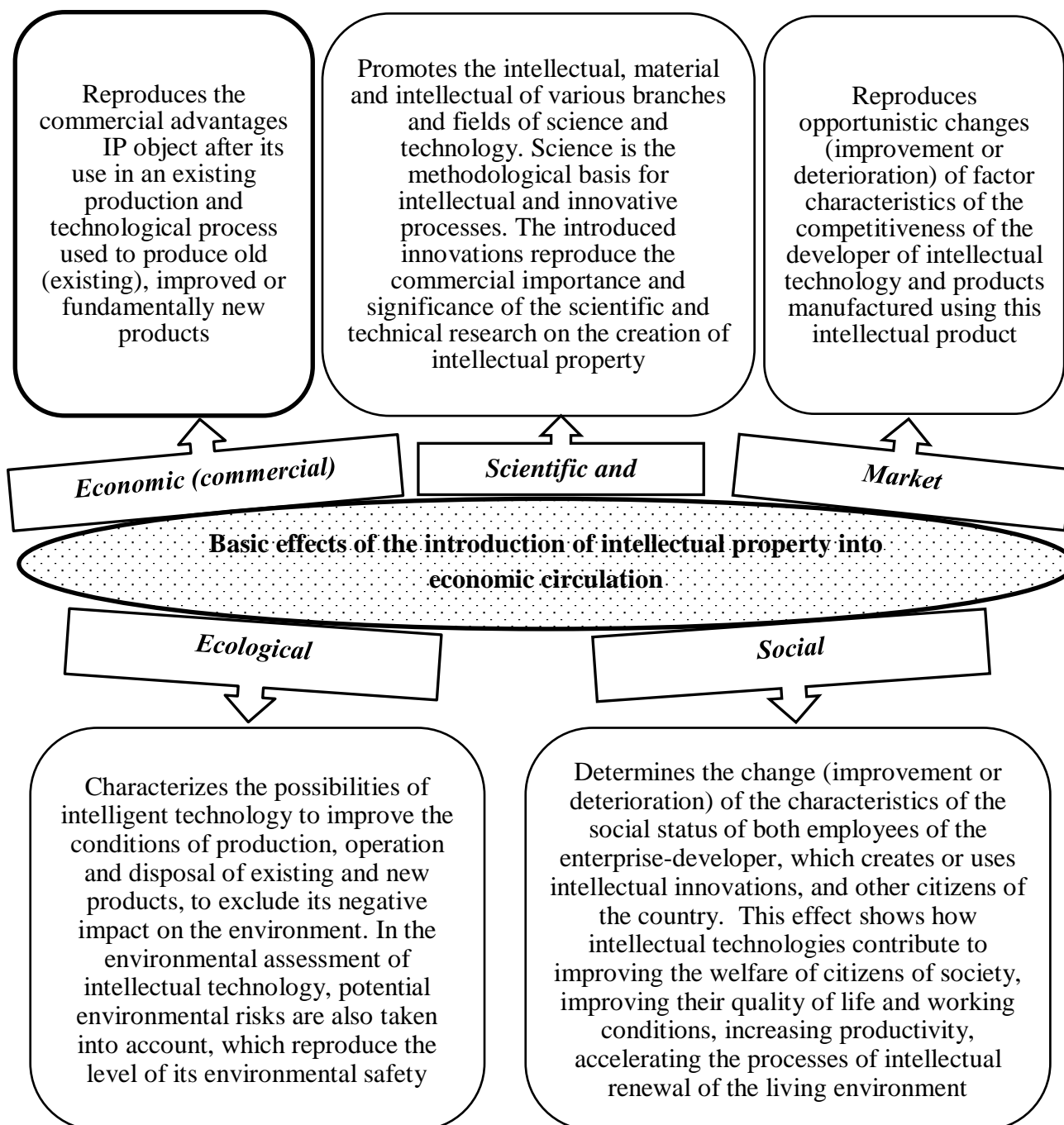
Figure 2 – List of basic effects of creating and using intellectual property and their characteristics

Source: developed by author

Based on the above assumptions, we can conclude that under different scenarios of introducing intellectual property into economic circulation by the developer, the probability of obtaining one or another effect will be different (Fig.1). Suppose that the developer fully transfers (sells, carries out the procedure of assignment of rights) its exclusive rights to the intellectual product to another consumer (copyright holder), then its original copyright holder will be more interested in the market effect, which at the same time will allow him to get a significant amount of profit that the lump-sum payment will provide him. The future (new) copyright holder, on the contrary, will be largely interested in the size of the

economic effect, since this type of effect will be able to provide this consumer with the necessary amount of profit by improving the activities of his business (of course, this is possible only if the buyer plans to use the intellectual product in his own production and commercial activities. At the same time, the size of the environmental and social effect also plays an important role, due to the fact that their presence will allow the seller to set a higher price, and the buyer will make more accommodating when conducting this kind of bidding. When considering a license (or other) agreement related to the use of intellectual property, in this case, the developer (seller, licensor) of an intellectual product may also be interested in the possibilities of environmental and social effects, due to the fact that these effects have a direct impact on the size of the market effect.

In pic. In Fig. 1 we showed the relationships betweendifferent types of effects of intellectual property, there are certain relationships depending on the form of its introduction into economic circulation, which is shown in Fig. 3.

Table 2 - System of effect-forming indicators of the use of intellectual property in the directions of their formation and definition

Effect-forming indicators of intellectual products that characterize...				
Economic effect	*Scientific and technical effect*	*Market effect*	*Social effect*	*Environmental effect*
Reducing production costs	Number of patents filed and registered	Increase in sales of products	Increase in income (salary) of employees	Reduction of hazardous production waste
Improving consumer quality indicators of innovative products	The growth of the intellectual component in the costs of living labor	Ensuring the necessary competitiveness of consumer products	Better satisfaction of the physiological needs of workers	Reduction of production emissions into the atmosphere
Increase in profit from the sale of IP	Increasing the level of mechanization and automation of production	Reducing the terms of sale of IP consumer products	Ensuring a high level of employee safety	Reducing production vibrations
More efficient use of technological equipment in the consumer's business	Increasing the share of the latest technological processes in production activities	Increasing the level of competitiveness of an intellectual product	Growth of professionalism and qualifications of IP consumer workers	Reducing hazardous emissions into water resources
More efficient use of business capacity	Increase in the organizational and managerial level of production activities	Increasing the value of technology developer goodwill	Improvement of existing working and rest conditions for employees	Reducing the level of hazardous emissions into the soil
The level of revenue from the sale of licenses	Increasing the number of scientific and methodological	Increasing market confidence of consumers	Creation of new (additional) jobs	Better product disposal opportunities

	publications			
Profit from the market sales of main products	Number of prepared and defended dissertations	Expansion of product sales market segments	Elimination of staff turnover factors	Increasing the level of ergonomics and aesthetics of IP consumer products
Reducing the payback period	High level of citation index of scientific papers	Increasing the effectiveness of marketing costs	Growth of the commitment rate to the company	
More efficient use of working capital at the consumer (turnover ratio)	Increasing the share of new information technologies in business activities (digitalization development)	Reducing the time for the development of new segments of technological markets for intellectual products produced using IP	Increasing the duration of work and life of employees and their families	Reducing the number and level of fines for violations of legislation in the field of ecology and environmental protection
Productivity growth	Establishment and effective operation of scientific schools		Increased spending on pensioners and veterans	

Source: developed by author

From the data Fig.3. It follows that the size of the market effect is important for the owner (developer) of an intellectual product in those variants of its introduction into economic circulation, when there is a possibility of absolute (complete) transfer of exclusive rights to another consumer or at least their partial delegation. In these options, the size of the market effect is the most important (determinant), on which the possibility of concluding the desired transaction for the developer (full sale or only license) depends to the greatest extent.

The conducted studies show that the level of market effect is influenced (with different strength and weight) by a large number of indicators and simple calculations when evaluating them is very difficult. It is not a big secret that the market effect of an intellectual product largely determines a comprehensive indicator of its competitiveness in the technological market, which allows the developer (owner) of an intellectual product to a certain extent successfully positioning and selling their intellectual development in this market.

A significant number of researchers of the technological market under the competitiveness of intellectual goods understand its relative complex characteristics, which reproduce its technological and scientific difference from competing intellectual technology and determine its attractiveness in the eyes of potential consumers. In our opinion, the problem lies in the correct understanding, identification and evaluation of this characteristic. Quite often, such a determination of the level of competitiveness of an intellectual product contains a real possibility of methodological error of the appraiser (researcher). In the available economic studies, there are often cases when scientists focus their efforts on the parameters of an innovative product (dividing them into to a certain extent characteristic groups) and then, to directly assess the level of competitiveness, compare with each other separate complex characteristics for different technological competing products.
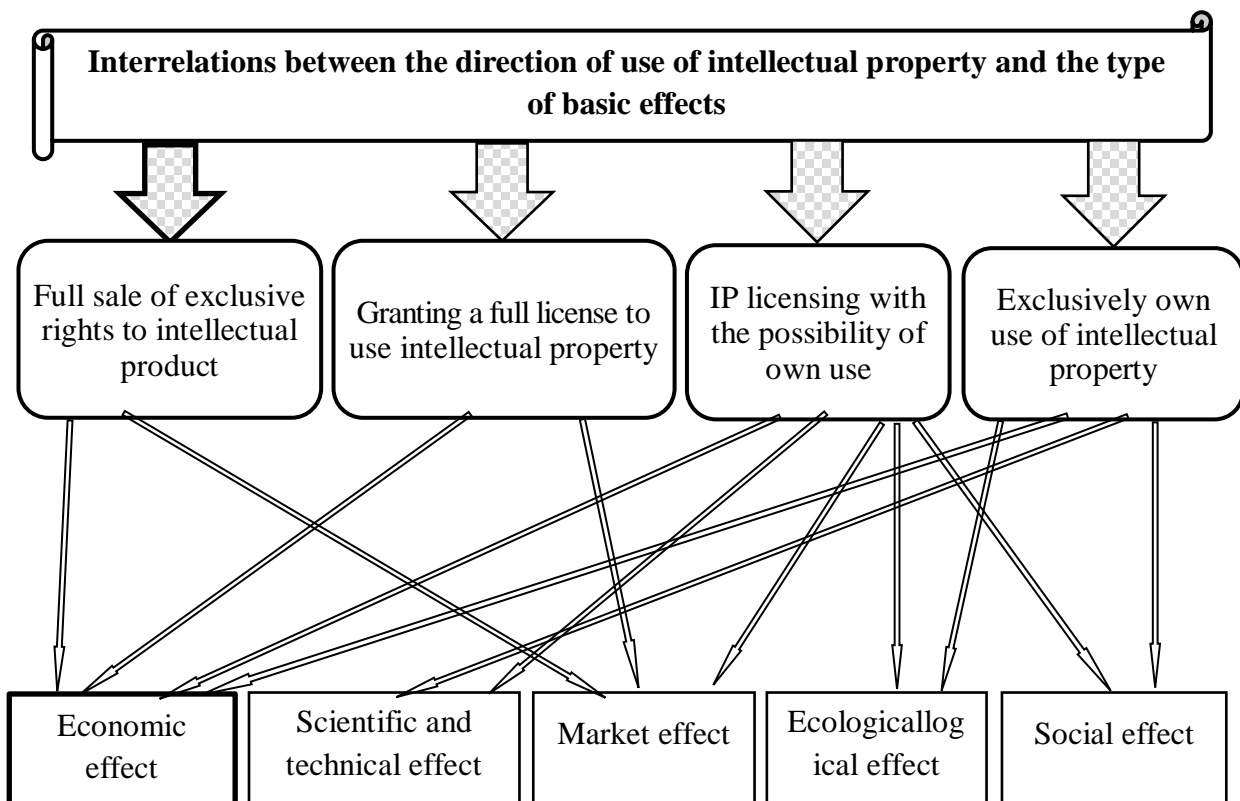
Figure 3 - The presence of basic effects of intellectual property in different areas of its use

Source: developed by author

Often this kind of assessment simply combines the factors of the technical level of the product and then the assessment of competitiveness is replaced by a comparative assessment of the quality level of analogues (competitors). Indeed, the desired level of quality of an intellectual product for different segments of the technological market may be different and the motto "higher quality level – higher level of competitiveness" or "greater level of economic effect – higher level of competitiveness" is not always acceptable for the technological market. Naturally, no one on the market will pay for low quality or for inefficient technology, but, on the other hand, no one will pay for excessive quality or for an unnecessary effect in these conditions. This is a well-known principle of marketing and should be respected at least to some extent. The characteristics and factors of intellectual technology should be exactly what a potential consumer wants them to be, no more and no less. It is with this level of quality that intellectual and innovative technology (intellectual product) will be implemented; it is precisely such a product that will have the highest acceptable level of competitiveness in this segment of the technological market.

It is possible to carry out economic valuation of intellectual property in various forms, according to the goal and methodology of the assessment and the individual specific features of the intellectual object. Depending on the availability of the necessary analytical information, it is possible to identify and analyze the most appropriate currently existing methods for performing the evaluation procedure. The

classification of existing methodological approaches to the economic evaluation of intellectual property is shown in Fig.4.
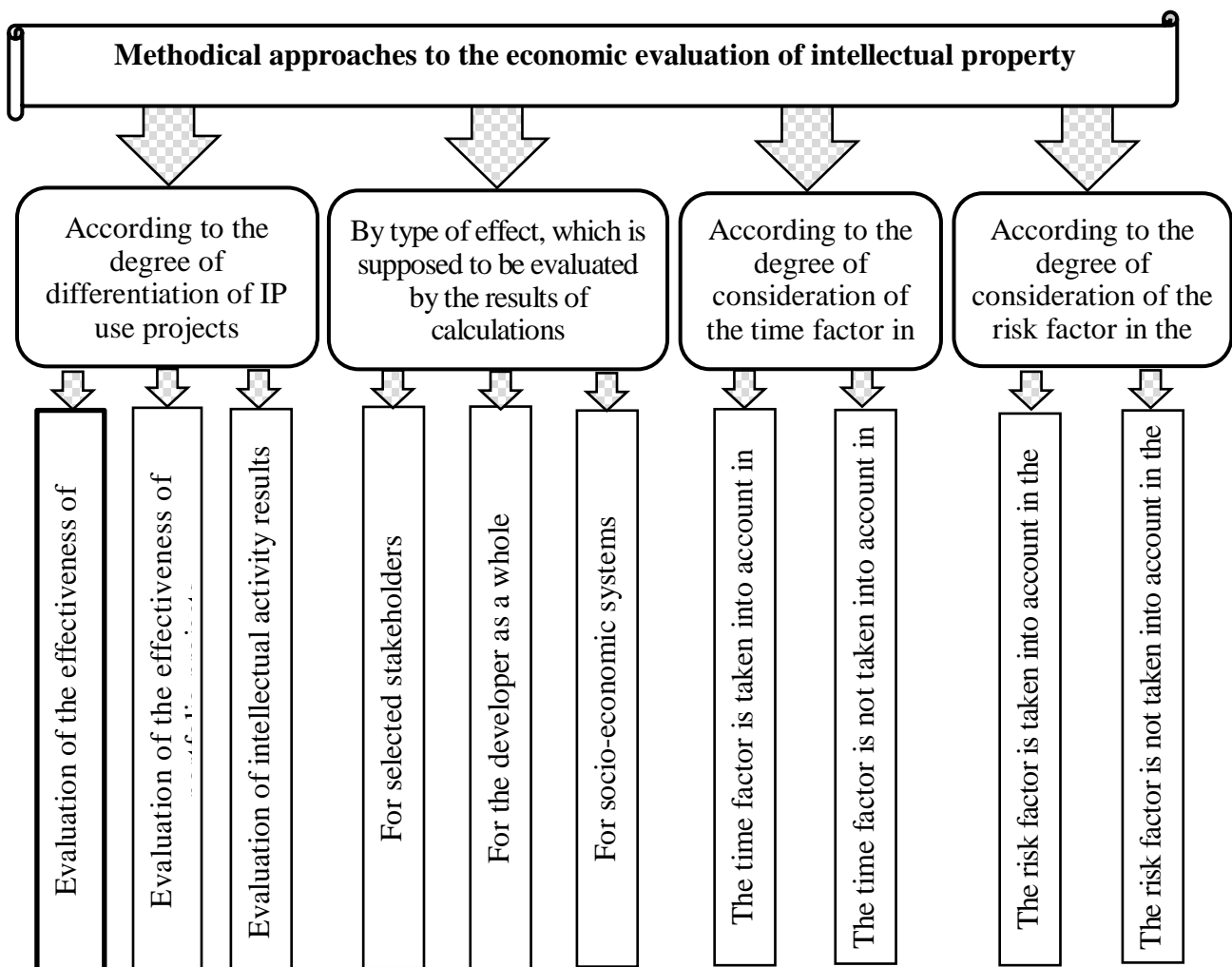

Figure 4 – Classification of methodological approaches to the economic evaluation of IP
Source: developed by author

The existing methodological base for assessing the economic efficiency of the development and use of intellectual property objects overwhelmingly uses three groups of methods.   The first group includes methods and guidelines based on the cost estimation of the cost of creating intellectual objects and income from their consumption.

The second group includes methods and methodological recommendations, in which the evaluation of intellectual and innovative activity is considered from the standpoint of the effectiveness of investments in intellectual and innovative projects. This aspect, in our opinion, is justified in conditions of self-sufficiency and self-financing, but at the same time it limits the study of the impact of intellectual products on the development of an industrial enterprise as a whole. In fact, intellectual and innovative activity of industrial enterprises is impossible without investment, which includes marketing research, investment for the sole purpose of preserving and increasing capital and making a profit. Thus, intellectual and innovative activity uses investments as a means to achieve the goal, since any innovation and any creativity require capital investments.

A number of researchers in this area [2, 11] propose to evaluate intellectual and innovative activity using an integral economic assessment, which includes diverse economic characteristics. We propose to divide existing models and indicators of comprehensive evaluation of intellectual and innovative activity of the enterprise and individual intellectual products into static, dynamic and rating.

Static models and indicators are most often referred to as those that are used for a rough assessment of intellectual and innovative projects and are used under the condition of slight inflation expectations. Dynamic models and performance evaluation indicators take into account changes in the value of money over time, leading them to the moment of decision making by discounting. In this case, the main criterion for evaluating the effectiveness of innovation is *NPV* [10].

In rating models and estimates the scope of application is wider than that of static and dynamic indicators, which allows analysis in situations of continuous intellectual and innovative activity with an indefinite moment of beginning [2, p.104]. In addition, the rating assessment summarizes indicators that reflect heterogeneous goals, which is their definite advantage, since the company often has several equivalent strategic goals. For this purpose, methods of multicriteria analysis and evaluation of intellectual innovations are used, which makes it possible to compare heterogeneous values expressed in different units of measurement and having a different nature - economic, social, environmental, etc. [11, c. 111-112].

The third group of methods for evaluating the effectiveness of intellectual products is used in close relationship with the type of effect that can be obtained when consuming intellectual property. This group of models is characterized by an integral approach, but their use complicates the identification of the reasons for the success or failure of an intellectual product and does not always allow the adoption of adequate (scientifically based) management decisions. In this case, simple effect-forming indicators are not enough, since they do not reproduce all types of tasks that are usually solved, which means that their role in assessing the efficiency of innovation activity of the region's electric power industry is underestimated, since discounted indicators serve the needs of investors, and the rest – industry needs.

The fourth group of methods evaluates the effectiveness of intellectual products, involves the implementation of appropriate calculations at individual stages of their life cycle. In our opinion, this group of methods, although insufficiently developed, is the most promising in terms of accuracy and validity of the results obtained. This approach, in contrast to those discussed earlier, is a component of not only economic, but also management analysis, which allows you to effectively manage the intellectual and innovative process in an industrial enterprise.

The Agat profile of the intellectual and innovative activity of an industrial enterprise provides every reason to consider all areas of its activity. At the same time, the assessment of the effectiveness of intellectual and innovative activity only from an economic point of view does not reveal its whole essence. To assess the effectiveness of its results, it becomes necessary to analyze both quantitative and

qualitative indicators of all types of possible effects, a detailed classification of which and economic essence have been investigated.

It is shown that the most important types of effects from the use of intellectualproducts are economic (cost indicators), scientific and technical (novelty, utility, reliability), market (demand, supply, price), social (social results) and environmental (indicators of the physical state of the environment). The integral economic effect from the implementation of intellectual and innovative projects is defined as the sum of all these types of effects. Thus, the integral economic effect of the application results of research and development includes all components of reproductive development.

It is substantiated that the evaluation of efficiency of intellectual and innovative activity of industrial enterprises should fully take into account an integrated approach to the concept of «efficiency». This means that in addition to indicators characterizing the economic effect of expenditures (investments) on intellectual and innovative activities, it is necessary to assess the degree of achievement of the goals of this activity in scientific, technical, market, social, environmental and other spheres, to combine quantitative and qualitative assessments, take into account the goals of all participants in intellectual and innovative activities. At the same time, the beneficial effect of the introduction of innovations cannot always be assessed only with the help of valuations or quantitative indicators. Therefore, with a qualitative approach, the effectiveness of intellectual and innovative activity of industrial enterprises should be evaluated from the point of view of maximum compliance with the set goals.

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11. TRENDS RESEARCH AND DIRECTION IDENTIFICATION OF E-COMMERCE INDUSTRY DEVELOPMENT

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Sales volumes in e-commerce have been steadily growing over the past decade. In 2020, global e-commerce accounted for almost 14% of total retail sales worldwide. This is a significant increase compared to 2013, when e-commerce accounted for only 6% of total retail sales [1]. According to Deloitte survey data in Ukraine, before the start of кussia's military invasion, an important trend was observed for the second year in suborder: a doubled predominance of growth rates online over offline. 22% of respondents indicated that they started to buy more often online, and only 9% shop more often offline. And this trend only intensified. In large part, thanks to the COVID-19 pandemic consequences, which has accustomed many people to buy online. As the research of Soul Partners and Baker Tilly Ukraine showed, the volume of the e-commerce market in 2020 increased by 41% and reached $4 billion, which was 8,8% of the total volume of retail trade in Ukraine. This share was expected to be 9,2%, or $4.4 billion, by the end of 2021. The e-commerce market has grown almost three-fold since 2016, and analysts have predicted it will double over the next five years.

Consumer electronics and clothing had the best prospects for sales increasing through the online channel in Ukraine. Accordingly, the share of online electronics sales was expected to grow from 23% to nearly 46%. Online clothing sales in Ukraine fell by an average of 26% since 2016 and reached $291 million in 2020. That is, about 7% of clothes were sold online, although the average check was small: $24-31. However, in general, Ukraine had the lowest level of spending per person on e-commerce per year in comparison with neighboring countries - $104. For example, in neighboring Poland, this indicator was at the level of $541/year, in the Czech Republic - $800/year [2].

In Ukraine, e-commerce is becoming an increasingly popular and important economy branch. However, in today's operating conditions, the development of this industry has somewhat slowed down due to economic instability. The war and related internal and external destabilizing factors have a significant negative impact on the activities of e-commerce entities. There is a need to study the e-commerce industry trends and prospects, development strategies and directions for optimization.

The e-commerce actualization as a branch of economy and functioning in war conditions forces foreign and domestic scientists to conduct research and make a significant contribution to its development. Worthy of attention are the works of Golovchak , K. Kutsko, I. Zaletska, and L. Prokopets devoted to the e-commerce features and economics. In particular, the authors note the essence of "electronic trade" – it's a buying and selling goods/services process, in which the entire cycle of a commercial transaction or part of it takes place electronically. It is based on the electronic devices use, such as computers, smartphones, tablets, to carry out purchase and sale operations via the Internet [3].

The scientific works of N. Kraus, K.Kraus and O. Manzhura make a contribution into formation and development of the electronic commerce theory [4]. The authors note that online business is qualitatively new technology that allow the company to achieve a competitive advantage by improving service to its customers and optimizing business relations with partners. E-commerce is one of the most important structural elements of modern Internet business. Factors affecting the development of the Ukrainian e-commerce market are described in the scientific work of Zh. Zhygalkevych and A. Grubar [5]. The authors also analyzed and presented the dynamics of changes in the e-commerce market current state in Europe and Ukraine.

D. Panfilova noted the COVID-19 pandemic impact on the accelerated digitalization of business, both in the world and in Ukraine in particular. By pushing consumers to move from offline to online, it created new challenges and opportunities for the e-commerce development. At the same time, it accelerated Ukraine's entry into the list of e-commerce markets [6]. O. Storozhyk, a practitioner in Internet-marketing, singled out the prospects for the e-commerce industry development, in particular, he showed the trends, tools and needs of online buyers [7]. Taking into account the significant contribution of the above-mentioned scientists to the scientific topics study related to the peculiarities of the e-commerce functioning in war conditions and economic instability, it is not sufficiently covered in the scientific studies of domestic scientists.

Since the full-scale invasion, the mass migration of the population to other countries had a significant impact on the e-commerce sphere. For Ukrainian retail, 5 million consumers who went abroad and spend there approximately $400-500 every month means a loss of potential income in the amount of $2,5 billion every month, or $30 billion per year. However, due to the successful actions of the Armed Forces, the situation at the front stabilized, as a result of which people began to return to Ukraine.

Among other important factors affecting retail, we can single out high inflation, high unemployment among the population, which provoked a decrease in purchasing power. Interruptions in the supply of electricity and heat at the end of the year led to a decrease in the income of trade networks due to limited functioning and additional costs for generators [8].

If we talk about the e-commerce market structure in Ukraine, the largest shares (27% each) belong to electronics and toys/goods for DIY (Fig. 1).
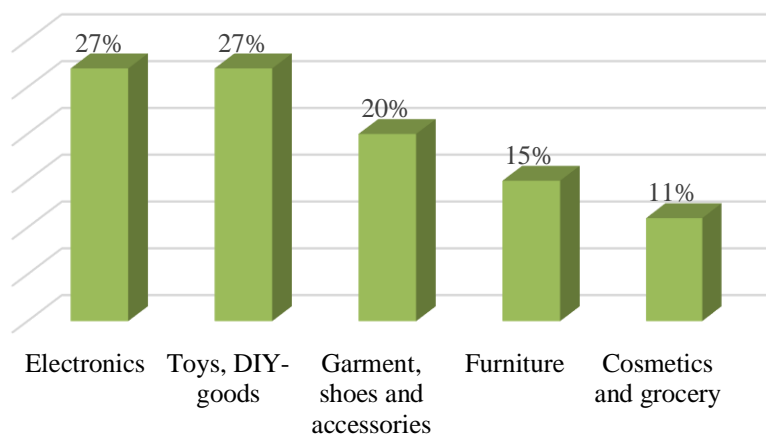

Figure. 1. E-commerce market structure in Ukraine

Source: [2]

The promising e-commerce segment "Clothing and footwear" also suffered large losses due to logistics problems and the impossibility of importing goods that did not belong to critical imports. Thus, according to the consulting company Pro-Consulting assessment, the clothes and shoes import, which do not belong to critical imports, decreased by almost 60%. However, this category has the highest and fastest recovery dynamics in the number of online users, which is associated with the people movement and the seasons change. The war changed not only the place of many Ukrainians residence, but also their shopping behavior patterns. In a new place, people cannot always find the necessary goods, so they began to order them online more often. The need to settle down in a new place caused a temporary increase in purchases of certain goods. Not only the geographical distribution, but also the gender distribution has changed: the share of men among online buyers has increased by almost 10%, until February 24, women and men bought approximately equally (50/50). Most buyers are aged 25-34. Moreover, the so-called pure online prevails, when 86% immediately buy the necessary goods online, and only 14% first search offline, and only then order on marketplaces. As the country recovers, building materials, household goods, appliances and electronics will be among the top sellers [2].

Deloitte's survey results in Ukraine on the consumer behavior subject in the second year of the war claim that consumers will be more sensitive to price than ever, which is why the online store or marketplace assortment must necessarily contains

low price category products. Among the advantages of online shopping, time saving, a wide assortment and ease of search are also highlighted (Fig. 2).
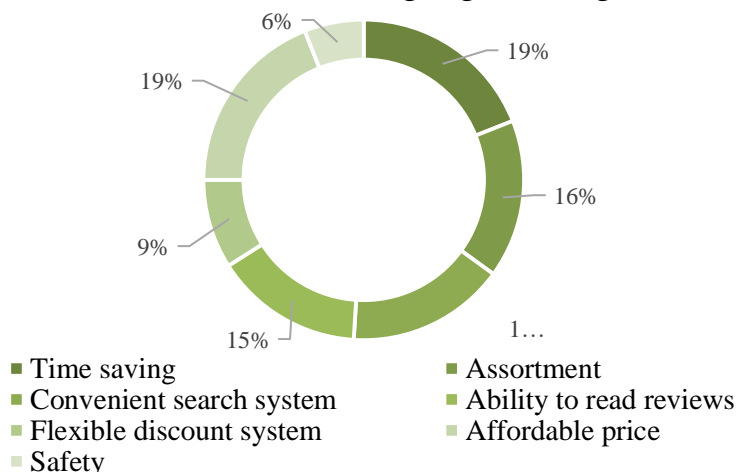
Figure. 2. Patterns of purchasing goods online

Despite the full-scale war, the e-commerce field has great potential for growth in the world and in Ukraine in particular. For Ukrainian retailers, this is an opportunity to survive and use new challenges, attract more customers, increase profits and expand market presence. For customers, the e-commerce market remains comfortable, accessible and safe from the point of making purchases view and receiving a wide range of services.

It is important to understand that war adds many risks and challenges, so all e-commerce market participants must be ready for changes. However, in order to maintain competitiveness, it is necessary to use modern technologies, strategies and innovations (Fig. 3).

Figure. 3. Modern approaches of retailers to increase sales

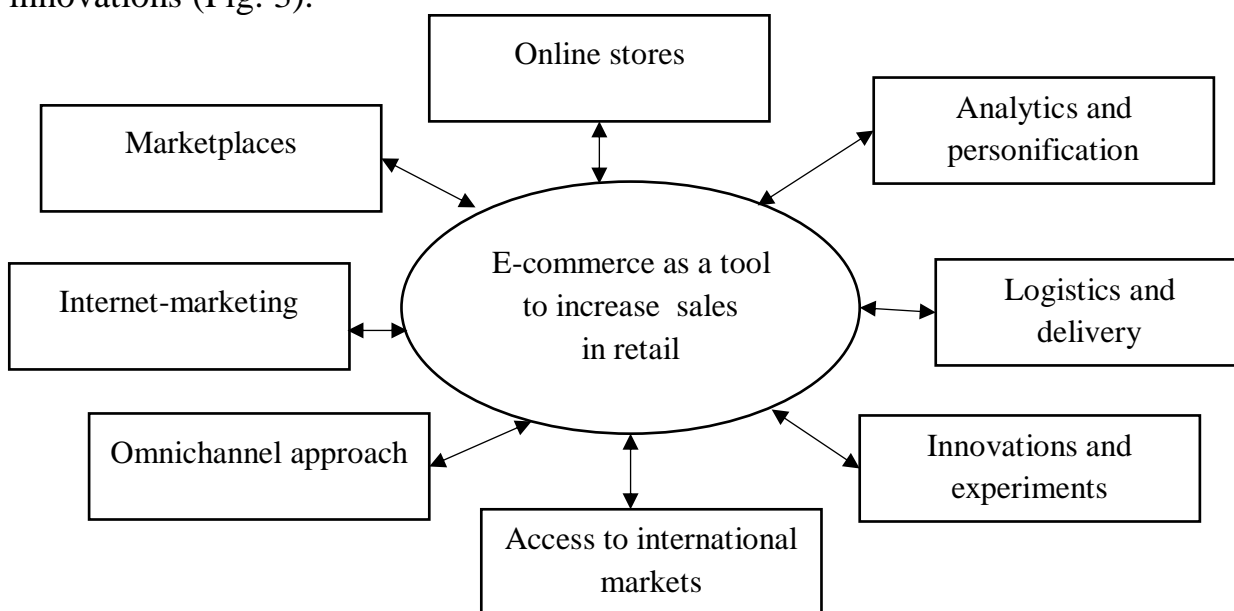Large retailers use e-commerce as an effective tool to expand their business and attract more customers. The main e-commerce tools for business expansion remain [10]:

1. Online stores where customers can make purchases in a convenient way and time. The client is offered a wide selection of goods and services, taking into account the online consumers needs, convenient methods of payment and delivery are provided.

2. Marketplaces can be used to sell goods, which provides greater visibility for buyers.

3. Omnichannel approach. Applying an omnichannel strategy, combining traditional and electronic sales channels, allows customers to order goods online and pick them up in store or vice versa. This approach gives customers more opportunities and expands the geography of service.

4. Internet-marketing. The use of marketing strategies allows more effectively promote products and increase the electronic sales indicators, choosing a specific target audience. The use of Internet-marketing technologies and tools allows to attract new and retain existing customers through promotions and loyalty programs.

5. Analytics and personalization are used to understand customer behavior and improve their online experience.

6. Logistics and delivery. Constant improvement of the logistics and delivery system is necessary to ensure efficient and fast delivery of goods to customers and returns.

7. Access to international markets. E-commerce provides opportunities to enter international markets by creating international versions of online stores, using international payment systems and different site languages to provide a convenient experience for customers from different countries.

8. Innovations and experiments. Today, business is open to new technologies, ideas and experiments in the e-commerce field. Using chatbots, virtual and augmented reality, it is possible to stand out in the market and provide a more attractive shopping experience for customers.

The field of e-commerce is characterized by: a high level of automation; use of Internet technologies for timely contact with the client; use of an omnic business model; constant quality control and service level. Given that regular e-commerce customers have some experience, there is a need to raise service standards and improve service, improve logistics (shorten delivery and return times, increase flexibility and reliability of order fulfillment), expand the range of goods and services; offer a lower price and bonus programs, increase the communication level through the Internet-marketing tools use (Fig. 4).

As e-commerce continues to grow globally, so does the need for companies to stand out from their competitors. The perspective in this direction depends on the immediate level of knowledge and skills in the field of Internet-marketing (Fig. 4) and the artificial intelligence use for analytics and personalization.
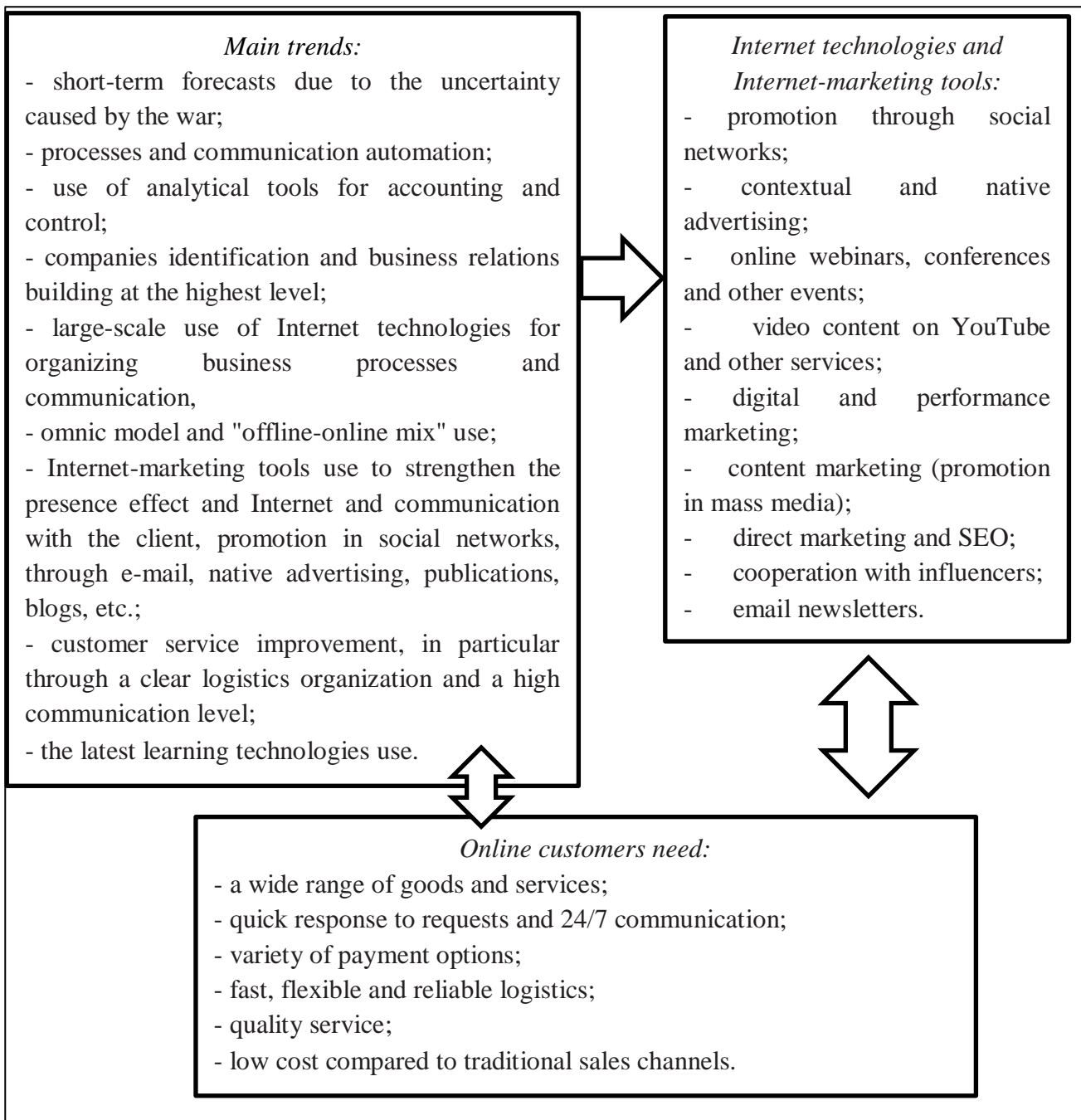
Figure. 4. E-commerce field features

The e-commerce key advantages were and remain simplicity, speed, convenience and security. If earlier purchases on the Internet were made mainly by young people aged 18 to 23 years, now goods and services are actively ordered online by a different age category of users: from 25 to 45 years old. This trend is developing thanks to the efforts marketers, who are increasingly focused on growing the age threshold. Another interesting trend is shopping through smartphones, not laptops or desktops. Such mobility and the ability to place an order anywhere and at any time catalyzes the e-commerce market development [7].

As already mentioned above, the war in Ukraine had a colossal impact on the e-commerce market, and it is simply impossible to deny it. The largest drop in electronic sites was observed during the first two weeks of the full-scale russian invasion. Growth began to resume in parallel with the work of the largest logistics operators - Nova poshta and Ukrposhta. Ukrainian entrepreneurs are flexible and managed to adapt quickly. At the same time, due to the temporary territories occupation and military migration in Ukraine, the number of the population that has access to e-commerce has decreased [11].

According to Statista, the e-commerce market in Ukraine showed steady growth in recent years before the start of a full-scale invasion: 2017 – 1180,65; 2018 – 1497,22; 2019 – 1848,99; 2020 – 2740,04; 2021 – 3506,98. However, already in 2022, against the background of the war, the requested volume decreased almost 12 times and amounted to only 295,85 million US dollars. At the same time, subsidence is observed in all areas, especially in the segments of fashion, furniture, toys and hobbies, beauty and health, electronics, etc. However, Statista's forecasts for 2023 are very optimistic. This year, the market volume is expected to almost reach the 2020level and amount to 2,671,05 million dollars. And in 2025, they will become even higher than in the pre-war year 2021 (Fig. 5).
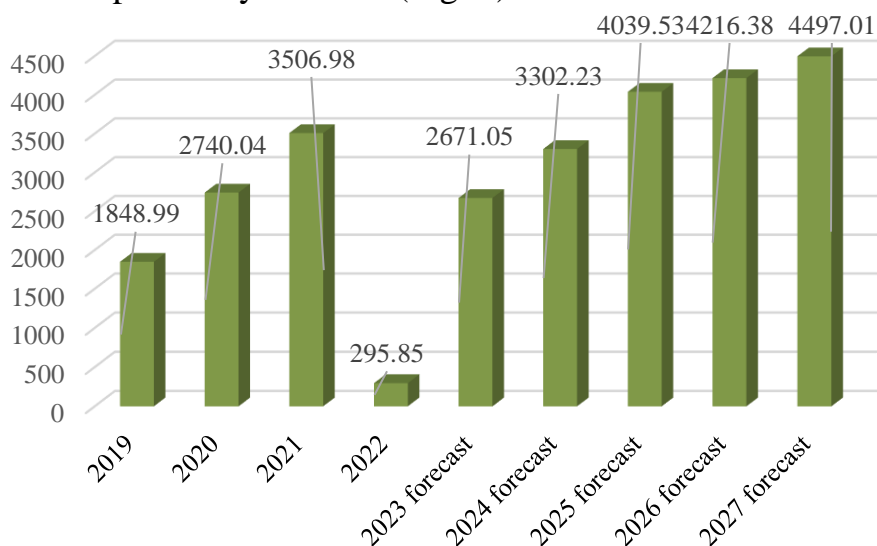
Figure. 5. E-commerce market volume in Ukraine, million US dollars

Source: developed by the authors based on [12]

Apparently, the worst times for e-commerce in Ukraine are behind us. Even if hostilities in the country continue, growth in both consumption capacity and production capacity is likely to occur, as production and business stabilize, volumes increase, and the Ukrainian economy demonstrates resilience even in such challenging times.

For a clearer picture, it is advisable to analyze the rate of e-commerce volumes growth in the world against the russian-Ukrainian war background. Analyzing the dynamics of previous years and the forecasted volume for 2023, a slowdown is observed, although not as significantly as one might expect (Fig. 6).
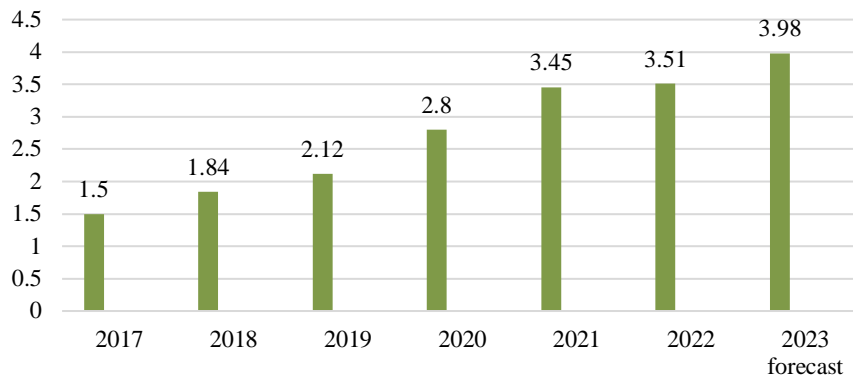
Figure. 6. E-commerce market volume in the world, trillion US dollars

Analyzing the data of fig. 6 we observe that after a rather noticeable jump from 2020 to 2021, the growth rate has decreased significantly by 2022 and it is predicted that they will not grow much in 2023. A more significant increase is expected only in 2024-2025, which is caused primarily by an increase in the number of customers. A stable increase in customers has been observed for a long time. So, it can be argued that the war in Ukraine had practically no effect on the consumers number on a large scale, but it is important to specify here that their increase is observed simultaneously with the increase in the global population. Therefore, we can come to the conclusion that even such a serious military conflict cannot significantly affect the overall picture.

Despite the unstable situation, many experts look to the future with optimism and give quite positive dynamics regarding the development of the e-commerce market in Ukraine (Fig. 7).
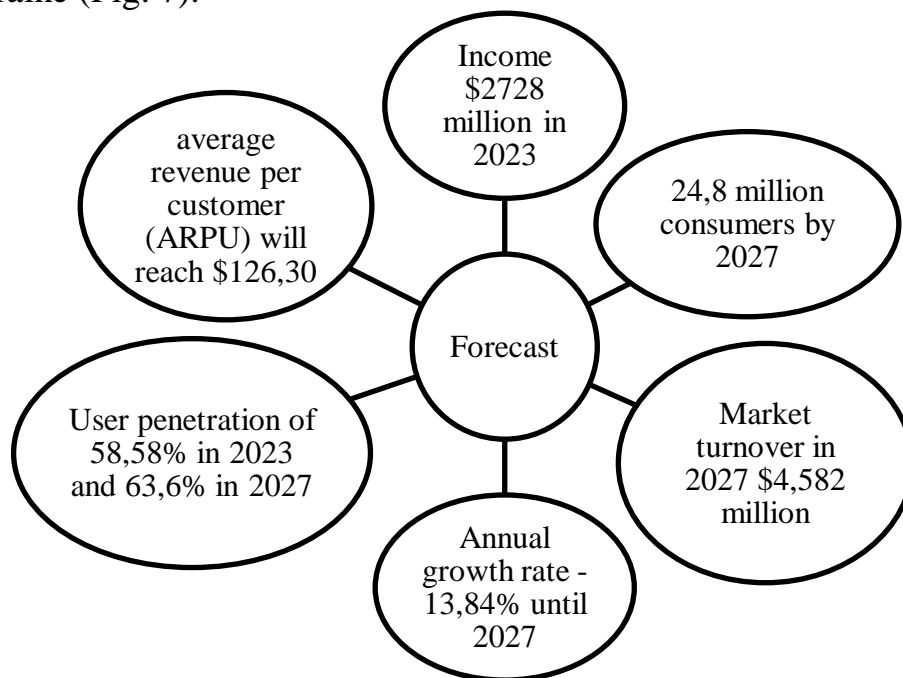
Figure. 7. Forecast for the e-commerce market development in Ukraine

According to the research results conducted by the Netpeak agency in Ukraine, Internet stores (55%) most often request the services of setting up Internet-marketing tools for business (Fig. 8).
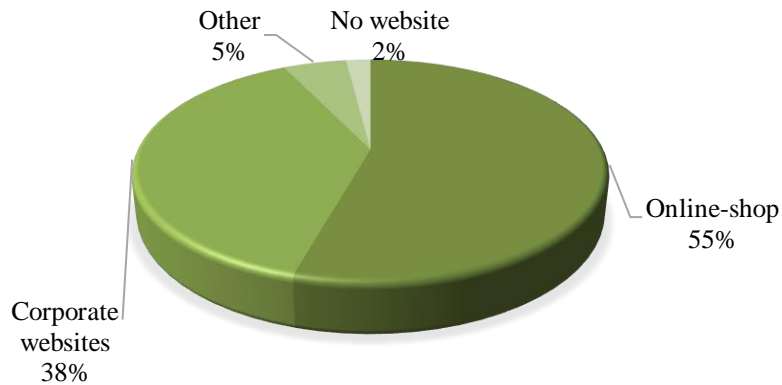
Figure. 8. Types of businesses that apply for Internet-marketing services in Ukraine

Source: [13]

As e-commerce companies continue to grow and expand, they need to master new technologies and tools to attract, service and retain customers. Attracting and keeping customers is possible through Internet advertising, in particular promotions and bonus offers, placement of recommendations on the site, remarketing, automation and personalization based on artificial intelligence (Fig. 9).
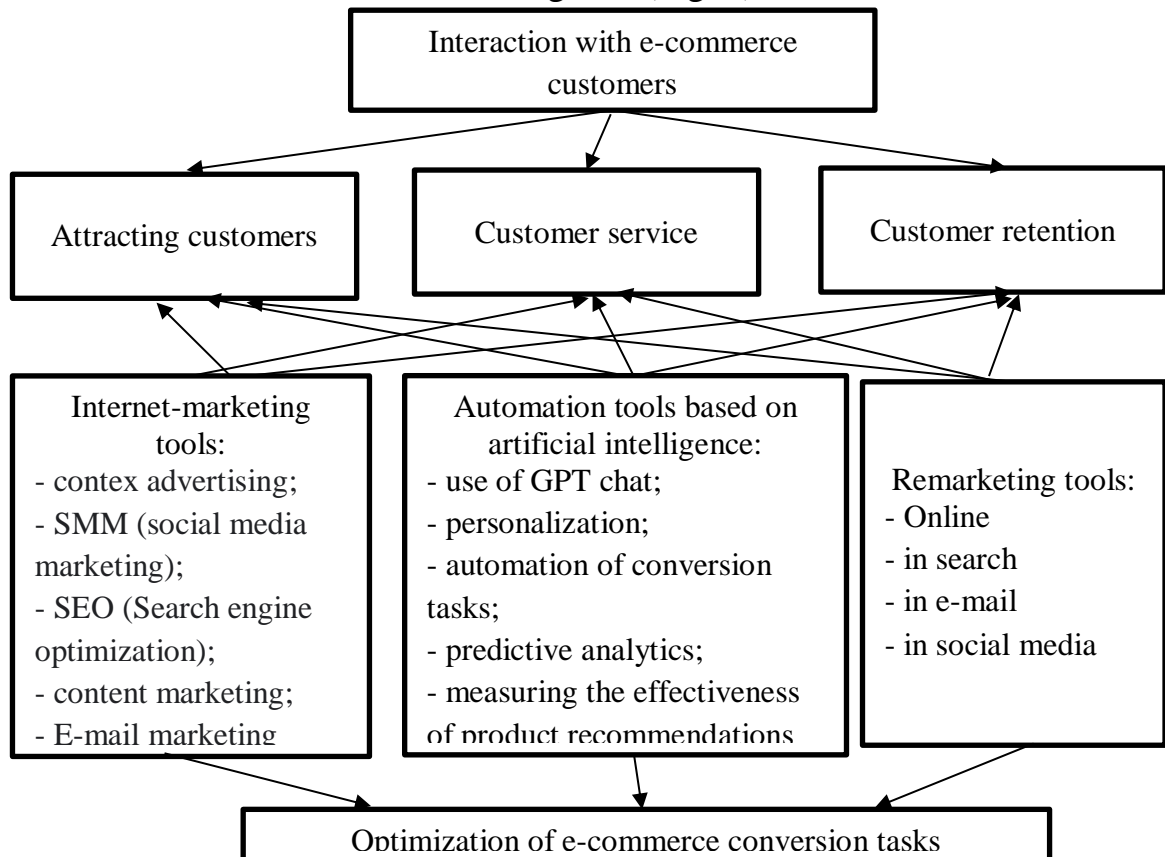
Figure. 9. Tools to improve interaction with e-commerce customers

Source: own development

The management of interaction with e-commerce customers includes the latest technologies use for the management functions automation: planning cooperation with customers, defining a cooperation strategy, determining the target tasks and cooperation priorities, analyzing the satisfaction and loyalty level of customers from cooperation with the company, creating a motivating system for regular customers, attracting potential customers, monitoring the cooperation and receiving feedback process from customers. Artificial intelligence, in particular, has enabled companies to automate the various tasks and processes required for successful e-commerce, businesses can minimize physical labor and significantly reduce costs associated with manual processes.

However, the war can create threats that will affect the e-commerce development in Ukraine. Below are some of them in the field of e-commerce, as the war in Ukraine consequences [14]:

– war may lead to fluctuations in demand for certain categories of goods and services in e-commerce due to the escalation of military operations or missile attacks, as well as a decrease in income and a decrease in consumer confidence;
– increased competition in the e-commerce segment: the number of companies offering goods and services may increase as a result of the new entrepreneurs registration on marketplaces due to the loss of a previous workplace;
– reduction in the service quality due to restrictions in the work of logistics and transport companies responsible for the goods delivery;
– an increase in the risk of fraud, as the control over transactions in e-commerce decreases and the appearance of a new sellers number sometimes unscrupulous;
– the e-commerce development in industries not related to war (online education or online entertainment that may be in demand in regions where physically obtaining these services has become unsafe or impossible).

In general, the e-commerce development in Ukraine can become an important factor in economic growth and raising the population living standard, as customers are always looking for new goods and services. E-commerce gives customers a wide choice and quick opportunities to satisfy their needs. Despite the challenges and risks associated with the war, e-commerce industry participants should: adapt their business to the relevant conditions; develop a risk minimization plan; use the best competitive strategies; automate routine processes; to scale. These solutions will allow to develop domestic business, attract customers, provide quality service and retain them.

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12. ARTIFICIAL INTELLIGENCE IN ARCHITECTURE AND EDUCATION: POTENTIAL, TENDENCIES, PERSPECTIVES

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Today, we are witnessing a new technological revolution, which is unfolding on the basis of the use of artificial intelligence (AI). It finds its implementation in all spheres of social life, economy and construction. As the founder and head of the Institute of Artificial Intelligence Problems in Ukraine, scientist Anatoliy Shevchenko, notes, a new type of society (Society 5.0) is actually being formed. Its production chains, logistics and social infrastructure will be based on the use of artificial intelligence [1]. Scientists face an important task of developing the concept of preventing risks associated with the use of AI, developing a legal framework for AI systems, and improving the transparency system when using AI. It is also important to comply with the norms of international humanitarian law, information security and the confidential use of data related to the use of AI systems in all sectors of the economy, including in construction and architecture.

According to Ukrainian scientists, foreign approaches to the use of AI cannot be effectively implemented in Ukraine. The modern specifics of our country determine the formation of alternative ways of AI development taking into account the leading world practices [1].

In this context, there is a need for scientific and pedagogical workers who are able to perceive, generate and practically implement AI technologies in the educational process. Today, the modernization of the learning process through the use of new technologies in education, including AI, is one of the modern directions of education development. Therefore, the direction of research related to the training of highly qualified teachers in the direction of using AI and involving them in the educational process in order to improve knowledge, skills and abilities is considered relevant.

As you know, artificial intelligence is a product of scientific thought of representatives of different countries. Therefore, the deepening of international cooperation is an essential condition for the development of this industry. In recent decades, the study of AI has been devoted to a significant number of publications and research. First of all, this issue is studied by those individuals who form the technological component of the development of the whole world. Among them are Elon Musk [2], Stephen Hawking [3], Mark Zuckerberg [4], Jeff Bezos [5]. These questions also concern specialists who work in leading laboratories and institutes for the development of AI as such. The scientific works of foreign and Ukrainian scientists are the theoretical basis of research. In their works, they analyze the future and the role of AI for the development of science, economy, and industry. These are the works of D. Markoff [6], N. Bostrom [7], M. Ford [8], D. Lanier [9], S. Romazanov [10], and others. Regulation of academic integrity and copyright when using AI is no less important. The works of many Ukrainian scientists, including V. Strelnyk [11], M. Stefanchuk [12], O. Petryshyn [13], and others, are devoted to this. To date, not many scientific works have been devoted to the study of the use of AI in architecture. It is necessary to note the works of O. Polyakova [14], A. Konotopenko [15], O. Nikolaieva [16] and K. Khorolska [17].

Today, there is a process of realization by architects of the exceptional potential of AI. The use of neural networks in architectural education and professional activity provides architects with opportunities, advantages and perspectives that were unimaginable before. Modern architects use AI to optimize the design process, create innovative forms and structures, and increase the energy efficiency of buildings.

So, when designing buildings, the first task is to create a concept. A neural network makes it possible to solve this task at a potentially high level. For this, architects use generative artificial intelligence – an AI tool that is able to create new content based on a request (input data). Several types of generative artificial intelligence can be distinguished: text generation (GhatGPT, Bing, Bard Rytr, Moonbeam, etc.); image generation (Dall-E, Midjourney, Stable Diffusion, Adobe Firefly, Replicate, Lexica, etc.); sound and music generation (AIVA, Ecrett Music, ORB Composer, Jukedeck, etc.); multimedia generative artificial intelligence (ImageBind Meta). The latest generative AI simultaneously considers six types of data (text, image, audio, perspective, thermal data and motion data using sensor devices).

Architects in their professional activities more often use generators such as DALL-E 2, Midjourney and Stable Diffusion. The quality of the images they produce can be stunning. So, for example, Stable Diffusion makes it possible to create a detailed, accurate image from a simple text description. This technology allows architects and designers to bring their concepts to life with an extremely high level of detail. It is a powerful tool for visualizing ideas, concepts in a short time (fig. 1).

Figure 1. Creation of visual concepts of the Tree House Project using Stable Diffusion

Zaha Hadid, an architect with a world name, can be cited as an example of the use of AI in professional activities. Thus, the president of the studio Patrick Schumacher notes that the use of AI is encouraged when creating visual concepts of objects, especially in competitive works and in projects at the idea generation stage (fig. 2). These image generators give interesting hints, new types of architectural forms, volumetric and spatial compositions [19].

Figure 2. Buildings created using image generators (DALL-E 2, Midjourney, Stable Diffusion) in Zaha Hadid Architects

Currently, there is no method of directly implementing generative neural networks such as Midjourney, DALL-E 2 and Stable Diffusion into real architectural practice. It is only possible to use them as a means of quick conceptualization or sketching. This greatly helps the architects' imagination and fantasy.

The creativity of the Egyptian designer Hassan Ragab is an interesting example. He explores new architectural forms as conventional building material. Hassan Ragab creates conceptual architectural works using the Midjourney image generator, studies the nuances of inputting raw data, freely mixes architectural styles with extraneous materials of biological origin (feathers, plant structures), smoke, etc. (fig. 3). Ragab believes that in the near future neural networks will learn to create 3D geometry, not just images on a plane [20].

Figure 3. Experiments with the use of artificial intelligence in architecture. Designer Hassan Ragab, Egypt

Elements of AI are already confidently entering our living space. Today, kinetic buildings and structures, interactive interiors and urban spaces are in the active field of vision of architects, urban planners and designers. The possibilities of introducing AI into the design of the internal environment of architectural objects have expanded. Among them is the Poem Pavilion at the Dubai Expo 2020 exhibition (by Es Devlin, Great Britain). It presents a "message to the cosmos", consisting of numerous poems. Visitors enter the building under the cone through the illuminated "Labyrinth of Inspiration" (fig. 4, left). Thanks to AR (augmented reality), the maze turns the passage into an exciting adventure. Another example is the Digital Art Museum (Tokyo, Japan, 2015), which completely erases stereotypes about museum buildings. Here, visitors can interact with virtual images and museum exhibits. There are no static objects in such an ultra-technological museum. The space is filled with interactive projections, multimedia illusions, light, color and sound. The project completely changes people's perception of museum standards and demonstrates an aesthetic combination of technology and nature (fig. 4, right). In addition, the projections and exhibitions with which people can interact are constantly changing - from multi-colored projections on bamboo groves to dancing with ghosts, entering the cluster of light and shadow... The museum is divided into five interconnected zones. The first zone – "Endless World" - is an interactive area of computer landscapes with waterfalls and forests. The second is the "Forest of Athletics" simulation area, where visitors are encouraged to engage in various physical activities such as jumping on a trampoline or rock climbing. The third zone is a space with an aquarium filled with digital fish "Future Park". The fourth zone is called "Lamp Forest". The fifth zone is "Tea House", where visitors can drink tea from virtual cups. The border between people and nature is blurred in this museum. These objects embody the 21st century and push architectural students to new creative ideas.

Figure 4. AI elements in the formation of interactive interiors

Therefore, the use of AI in architectural design at the idea generation stage makes it possible to obtain clear, detailed images and a realistic representation of the

future building. It should be noted that AI is definitely a useful tool for architects and designers at the conceptualization stage. On the other hand, abuse of this resource in the educational process deprives students of the opportunity to independently create ideas, relying only on their own intelligence. This can gradually lead to a certain degradation of a person (the student of education) as a creative personality. If a person completely transfers his creative activity to ChatGPT, then he may begin to decrease certain intellectual qualities, such as: the ability to think, analyze, understand, plan, perceive independently. A person loses analytical thinking skills, becomes dependent on technology. In addition, the issue of copyright (academic integrity) regarding the use of AI in the field of architecture remains unresolved today. Therefore, it is important to maintain a balance regarding the use of neural networks in the education of architectural students, understanding the advantages and disadvantages of this process.

The next step, which is solved by AI, is the development of detailed building models using text prompts and special BIM CAD tools. AI software allows you to analyze, predict, model, calculate and test implemented solutions. Such digital solutions allow architects to develop a project with the subsequent possibility of editing, deleting and making corrections. The neural network also makes it possible to analyze various parameters and factors. Among them are climatic conditions, site geometry, project estimate, consideration of customer requirements, etc. In general, all this allows an architect to make informed decisions and, as a result, to design effective and functional buildings.

In the architectural educational environment, when studying disciplines in both face-to-face and distance formats, there is an opportunity to use the following new technologies and trends:

– *elements of artificial intelligence (AI),* in particular – the inclusion of the computer game "Urban planning game" in classes for the development of spatial thinking, the formation of an understanding of one's project decisions in the perspective of the city development and its spaces, the construction of virtual new cities with full infrastructure, creative thinking and improvement of language skills (professional terminology in English);

– *elements of virtual reality (VR)* – creation of the illusion of reality using the computer program 3ds Max and Google maps for the possibility of virtual visits to urban spaces, evaluation of their architectural, planning and landscape solutions "on the spot", clarification of problems and search new solutions for improving the architectural environment of the city;

– *elements of augmented reality (AR),* in particular – the use of the above-mentioned computer programs 3ds Max and Google maps for the construction of new architectural objects and verification of the results, virtual visualization of the new object in the existing environment, finding out the possible results of such solutions.

Therefore, the use of AI in architecture has the following advantages:

– saving time and resources – the possibility of using AI generators is one of the key advantages;

- implementation of architects' own concepts with unsurpassed detail and precision;
- a powerful tool for visualizing unprecedented ideas in a short time;
- assistance in the processing of raw data and the implementation of an architectural project;
- minimization of errors and maximization of building efficiency with minimization of damage to the environment.

However, it should be noted that along with the numerous advantages of implementing AI in architecture, there are also certain concerns about the significant changes that may occur in the profession. So, for example, Chilean designer Sebastian ErraZuriz believes that 90% of architects may lose their jobs because AI will take over the design process [23]. Architecture studio Wallgren Arkitekter and Swedish construction company BOX Bygg have created a parametric design tool called "Finch" that can design floor plans adapted to site constraints [24].

Another area of use of AI in architecture, which has been around for several decades, is building management and the improvement of the concept of "smart building" or "intelligent building". These terms mean buildings connected by systems with artificial intelligence. They can control various aspects of the building, such as energy consumption, resource conservation, temperature, security, reducing operating costs, providing a clear control and management interface. This not only improves the efficiency of buildings, but also improves the comfort and safety of users. The system must be able to recognize specific situations occurring in the building and respond to them accordingly. One of the systems can control the behaviour of others according to pre-developed algorithms. In addition, the automation of some subsystems provides a synergistic effect for the entire complex. This allows the building to have high characteristics of functionality and flexibility, while at the same time restraining the cost of construction and operation. The automation of a smart home is similar to a children's Lego constructor. It is based on the same principle, according to which, having a certain set of elements, you can create a building of any configuration and complexity.

An interesting example is the construction of a city in Chongqing (China), which will be completely controlled by a neural network. The Gloud Valley project was developed by the Danish architectural firm Bjarke Ingels Group (BIG). Construction should be completed in the middle of the 21st century. In this futuristic place, AI technology will anticipate people's needs and meet them with the latest machines, devices and software. The goal of the Cloud Valley AI City building project is to unite people, technology and nature. The compositional form of the city is based on the shape of the relief, which is formed as a result of the decomposition of rocks. Under the clouds and between the mountains, AI City is where Terminus and the world's leading technology companies strive to advance the future of AI and robotics and create the foundations of a new sustainable development. According to BIG, the green carpet on the roof, forming the building's valley and mountain, will be a gesture of the meeting of technology with nature and at the same time the largest

night-time digital screen in China. Gloud Valley is the first project in the high-tech zone, which will become the newest innovation center of China. It will be a city where people, technology and nature flourish together with spaces designed for all kinds of life (fig. 5) [25].

Figure 5. The urban campus in Chongqing, China will be completely managed by artificial intelligence (AI). Architecture firm Bjarke Ingels Group (BIG), Denmark

Sourse: Ravenscroft T. (2019) They build a city in China with artificial intelligence that will "read" the minds of its inhabitants

Another type of use of AI in architecture is the construction of buildings using a 3D printer. European and Eastern countries have such experience. Ukraine is also gaining this experience. So, in the city of Lviv, with the help of a 3D printer, the Danish company of Mikell Brich is building a school in which 100 pupils will be able to study. The advantages of this technology are the absence of the need for internal and external finishing works, saving time and resources [26].

These technologies are also introduced into the educational process of students of architectural specialties. They perform practical modeling tasks using 3D printers. Thanks to this, students get to know modern methods in the work of an architect. 3D modeling tools, supplemented by AI, open up incredible opportunities in the educational process of future architects with the possibility of their further use in professional activities. This will make it possible to improve not only the work of architects, but also the cooperation between the customer and the architect. The

customer will be able to receive offers, information and the best project solutions in one place. This will make it possible to improve the entire design process and introduce a joint approach focused on "collective intelligence", and not only on artificial.

So, the prospects for using AI in architecture include:
- opening of new opportunities for construction, architecture and design. The use of new tools that open up unlimited possibilities for creative imagination and self-expression;
- change of the entire design process and introduction of a joint approach focused on "collective intelligence";
- the need to integrate into AI information about the environment, places where construction is planned, environmental conditions, project financing and other "more pragmatic things".

Artificial intelligence today evokes the greatest number of multifaceted, sometimes contradictory emotions. This is the active promotion of technologies related to its further development, and it's almost complete denial. It is obvious that the rapid development of the neural network creates both additional opportunities and threats for its users. In addition, AI pushes the average person to become more aware and responsible. Nick Bostrom, a professor at the Faculty of Philosophy at Oxford University, in his book "Artificial Intelligence. Stages. Threats Strategies" concludes about the inevitability of the development of intelligence – both artificial and human. The only question is in which direction this development will be directed [27].

Currently, there is no unified approach to understanding the nature of artificial intelligence in the technical, particularly in the architectural sphere. This causes some uncertainty in the legal, social, moral and ethical fields. There is an ongoing dialogue between different groups of lawyers regarding the legal aspects of the advantages, benefits, threats and risks of the development of artificial intelligence. As well as a discussion about the need to develop new mechanisms for the implementation of legal responsibility and compensation for damages in the conditions of the artificial intelligence use. It is obvious that it is difficult or almost impossible to stop the development of artificial intelligence. Nevertheless, the creation, implementation and use of artificial intelligence must undoubtedly be socially oriented. This process should correspond to the interests of human security, preservation of his personal space, will and self-awareness.

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13. BANKING TRANSFORMATION IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

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The recognition by the global community of the irreversibility of environmental and socio-economic problems caused by economic growth, which threaten the lives of present and future generations, has led to the formation and dissemination of the concept of sustainable development. Profit is no longer considered the sole criterion for success and the determining factor for investors. The priority issues have become environmental preservation, depletion of Earth's resource potential, climate change, and deepening inequality, all of which form the foundation of sustainable development.

In the context of achieving sustainable development goals, both at the national and global levels, finance plays a crucial role as the primary tool for achieving these goals. Consequently, finance, in the context of an orientation towards sustainable development, acquires new characteristics – stability and responsibility. Since banking institutions accumulate significant financial resources and determine the direction of financial flows, due to the nature of their activities, they can and should become drivers of sustainability and actively contribute to sustainable development.

Stability and practices related to the environment, social sphere, and corporate governance (ESG) have received increased public interest over the past decade. The role of the banking and capital markets in addressing these issues needs to be reconsidered. The global trend towards sustainable development is already fundamentally transforming the global banking sector. Banks must now integrate sustainable development regulatory requirements into their systems and adapt to the changing market demands [13 p. 6]. The global development of society requires sustainable development, and sustainable development is realized through sustainable banking. Thus, the evolution of the sustainable development paradigm has initiated the concept of sustainable finance, particularly sustainable banking.

The conducted research has revealed a significant interest among scientists and intergovernmental organizations in the issues of sustainable development, as evidenced by a large number of scientific articles and analytical reports. However, the problems of sustainable finance and sustainable banking are still insufficiently explored in research. We will focus on the most significant works.

The International Institute for Sustainable Development (IISD) defines sustainable finance as "the provision of financial capital and risk management services in a form that ensures economic growth, social justice, and environmental stewardship" [11]. D.V. Klynovy [12] substantiates the theoretical and methodological foundations, as well as the practical mechanisms and tools for shaping sustainable finance as a component of the sustainable economic system, providing a characterization of financial mechanisms for sustainable economic development.

I.P. Vasilychuk examines the peculiarities of developing the banking sector based on the principles of sustainable development, considering the role of banks on two levels: "banks as objects of the global process of disseminating the paradigm of sustainable development (external perspective) and banks as subjects of the process of implementing the principles and criteria of corporate social responsibility and sustainable development in banking activities (internal perspective)"[25]. Thus, sustainable banking is inseparable from social responsibility, which provides grounds for using the term "socially responsible banking."

L.P. Gulyaeva, in her study of banking activities, also emphasizes responsibility: "Financial institutions that join the problems of sustainable development are reorienting their activities towards responsible financing..."[8].

The review of literature sources has shown that the concepts of "sustainable finance" and "sustainable banking" are in the early stages of development and lack proper theoretical and methodological justification. Therefore, the issues of sustainable banking require detailed research into their theoretical and practical aspects.

Sustainable development is one of the three global trends that have influenced the global financial sector in recent years, alongside technological revolution and geopolitical tensions. The principles of sustainable development are being increasingly implemented in the field of finance, leading to the emergence of concepts such as "sustainable financing," "sustainable finance," and "sustainable banking."

The financial sector holds enormous power in funding and bringing awareness to issues of sustainability, whether by allowing for research and development of alternative energy sources or supporting businesses that follow fair and sustainable labor practices. Sustainable finance is defined as investment decisions that take into account the environmental, social, and governance (ESG) factors of an economic activity or project [9].

Sustainable finance is about including environmental, social and governance considerations in investment decisions [6]. It leads, in the long-term, to more

investment in sustainable projects and activities. It plays a key role in delivering on the objectives of the European Green Deal, which aims to boost the green transition.

The foundation of sustainable finance is laid out in the Paris Climate Agreement, which includes commitments to align financial flows with low-carbon and climate-friendly development pathways.

Banking activities cannot be separated from responsibility. Therefore, sustainable banking is organically linked to corporate social responsibility (CSR). Based on CSR, a bank integrates socially important and environmental issues into its operational model and interacts with its stakeholders. A bank operating on the principles of social responsibility should establish business processes that not only generate profits for shareholders but also address various societal needs. The particularity of the modern financial world lies in the fact that these two aspects are not contradictory but rather have a unidirectional relationship, being interrelated and interdependent. Thus, banking in contemporary conditions acquires another important characteristic - it must be socially responsible.

Socially responsible banking, as a type of financial intermediation, is based not only on economic but also on non-economic (social, environmental, moral and ethical) criteria.

Several directions of socially responsible banking can be distinguished: sustainable, green, ethical (Figure 1). They all share a common feature: considering social and environmental factors in their operational activities and following moral and ethical guidelines. Implementing such an approach, which aligns with global trends, requires a strategic approach, stakeholder identification, dialogue establishment, and information transparency.
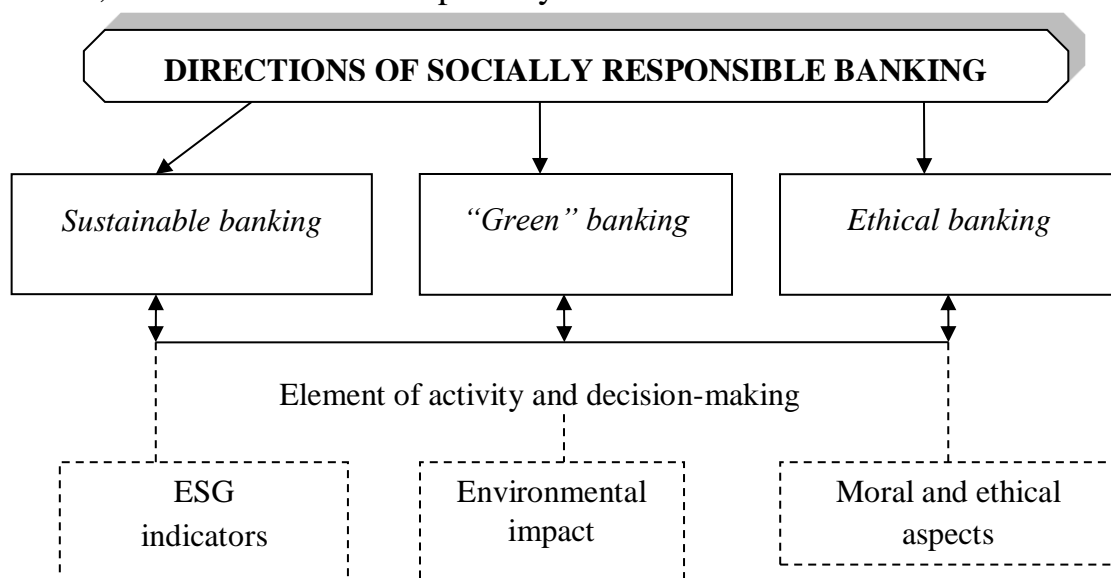

Figure 1. Directions of socially responsible banking
Source: authors' development

Clear demarcation between the mentioned directions of banking activities is practically impossible. "Green" banking, in essence, is sustainable as it promotes sustainable development, and adhering to moral and ethical requirements for banks as

institutions working with other people's money should become the norm. Ethical banking involves an exaggerated influence of ethical aspects on traditional banking activities. The criteria that guide a particular type of banking can have both limiting and stimulating characteristics.

1. Sustainable banking is a system of scientific views on socially responsible banking. In practical terms, sustainable banking involves the implementation of socially responsible approaches both in corporate management and in the banks' operational activities. The policy of sustainable banking is built considering ESG criteria (environment, social, and governance) as tools for risk reduction. ESG indicators reflect the extent to which a company is focused on strategic development and are thus an important factor in making investment and credit decisions.

Responsible banks strive to incorporate sustainability in all areas of their banking business. In other words, sustainable banking involves managing credit and investment portfolios considering social and economic effects, taking into account ESG aspects in the analysis of credit and investment risks, and implementing the concept of CSR, ultimately aiming to improve reputation (internal effect) and contribute to a sustainable future (external effect).

Banks analyze ESG indicators of companies to which they provide financing and report on their own achievements in ESG indicators in their activities. Numerous case studies of banks show that ESG indicators are increasingly penetrating banking operations: banks publish non-financial reports, link the value of a loan to the assessment of ESG indicators, and consider ESG indicators to improve operational activities.

The agreement signed by Oschadbank and Deutsche Sparkassenstiftung für internationale Kooperation on August 4, 2023, regarding the implementation of international sustainable development standards ESG can be considered a step towards achieving sustainable banking. This project primarily focuses on integrating ESG standards into the operations of micro, small, and medium-sized business service units [18].

Ukrainian banks declare their commitment to sustainable development on their official websites, especially those that belong to international financial groups. For example, UKRSIBBANK, as part of the global international financial group BNP Paribas, states that it "strives for sustainable development with a positive impact on society and the environment for a better future." In 2021, the bank's main shareholder, BNP Paribas, was recognized by the international financial publication Euromoney as a leader in global efforts to create a sustainable economy and was awarded as the "Best Sustainable Finance Bank" and "Best ESG Data and Technology Bank in the World". Currently, UKRSIBBANK is implementing a pilot project in Ukraine for assessing the ESG practices of its corporate clients. The idea is to offer borrowers a unified approach to ESG assessment that will grant them access to financing on individual terms [21].

ESG issues are also under consideration by the National Bank of Ukraine (NBU), which plans to develop requirements for reflecting ESG aspects in the corporate governance system of banks. The NBU also plans to establish ESG risk

assessment standards for banks and incorporate them into their operations [17]. In 2023, the NBU will initiate two-year training programs for bankers on ESG information disclosure standards.

An example of sustainable banking in Ukraine could also be considered the activities of the "First Ukrainian International Bank" (FUIB). In April 2013, FUIB joined the UN Global Compact, thereby declaring its adherence to the ten principles of the Global Compact and began implementing sustainable development principles in its daily operations. The bank has chosen the following sustainable development goals: Decent work and economic growth (Goal 8), Quality education (Goal 4), Good health and well-being (Goal 3), Gender equality (Goal 5), Industry, innovation and infrastructure (Goal 9), Peace, justice and strong institutions (Goal 16), and Partnership for the goals (Goal 17) [2]. In 2015, FUIB first published a Progress Report for all stakeholders and has since been providing annual reports on the work done. The bank has chosen social responsibility and management as its key focus areas, with less emphasis given to environmental conservation.

2. "Green" Banking. One of the directions of banking activity aimed at ensuring sustainable development is the model of "green" banking. "Green" banking is a banking activity that creates opportunities for mitigating the negative impact on the environment and enables the private sector to benefit economically from conservation efforts. This involves finding a balance between economic benefit and effective market strategies based on addressing a range of environmental issues [5]. In many countries around the world, "green" banking is a profitable activity with a successful financial model that is gaining popularity, although the concept of "green" banks is not officially registered.

Considering that the environmental situation worldwide is not significantly improving despite significant efforts by the global community, this direction of banking will be extremely popular.

Special attention is currently being given to achieving climate neutrality. The Paris Agreement states that "financial flows need to be aligned with a low-carbon and climate-resilient development." Since financial flows are predominantly governed by financial institutions, banks can play a significant role in combating climate change and investing in the transition to a climate-neutral economy.

Central banks of countries are also involved in promoting sustainable development through the greening of the financial system. On December 12, 2017, the Network for Greening the Financial System (NGFS) was established as a group of central banks and supervisory authorities who voluntarily expressed their desire to exchange experiences and best practices for the development of effective climate and environmental risk management systems. Currently, the organization has 87 members and 13 observers. The aim of the NGFS is to consolidate efforts and draw public attention to the achievement of the goals of the Paris Agreement, strengthen the role of the financial system in risk management, and mobilize capital for "green" investments. Membership in the NGFS will allow the National Bank of Ukraine to exchange experiences and research in the direction of greening the financial system with regulators who have already made significant progress in this matter.

Also created and functioning is the Green Bank Network, which brings together leaders in the field of financing clean energy and supports investments in clean energy worldwide. The organization's website states that "green banks promote private investment in low-carbon, climate-resilient infrastructure. Over the past few years, more than ten national and subnational governments have established state green banks" [7].

The European Bank for Reconstruction and Development (EBRD) is a global leader in climate financing. By 2022, it has committed to align its activities with the Paris Agreement and, by 2025, become a majority "green" bank.

In Ukraine, the undisputed leader in green banking is UkrGasBank, which actively finances eco-projects. As of 2021, the bank has financed approximately 600 million Euros in renewable energy and around 300 million Euros in energy efficiency. Other "green" directions of the bank include a program for purchasing new agricultural machinery with reduced CO_2 emissions and an energy efficiency company for housing cooperatives [22].

At the national and supranational levels, tools are being developed to promote sustainable investments. One such tool is the EU Taxonomy, which is part of the European Commission's action plan for financing sustainable development. The EU Taxonomy is a classification system that establishes a list of environmentally sustainable economic activities and serves as a transparent tool for companies and investors. It introduces clear efficiency criteria for determining economic activities that make a significant contribution to achieving the goals of the European Green Deal. It has been developed to provide a clear description of what is considered "green" and to stop "greenwashing". The main goal of the taxonomy is to channel private and public capital towards sustainable financing.

Since Ukraine is currently in the early stages of implementing ESG (Environmental, Social, and Governance) and sustainable investment standards, a number of international organizations and programs, including the United Nations Development Program, emphasize the need to develop its own taxonomy in Ukraine. This will allow for the establishment of a classification system for economic activities that promotes environmental sustainability and climate neutrality. Developing such criteria will be essential for effective post-war reconstruction.

3. Ethical banking is a banking activity consciously limited by selected criteria that are positively evaluated in society [4]. These criteria mainly consist of principles based on social responsibility, sustainability, ecology, ethics, morality, and religion. One of the most important documents in the work of ethical banks is considered to be "The Collevecchio Declaration on Financial Institutions and Sustainability," which outlines the main principles of ethical banking; a commitment to sustainable development, the principle of "do no harm," responsibility, accountability, transparency, and support for market stability and related state policies [3].

A prominent example of ethical banking can be seen in the model utilized by Islamic banks. The financial system of the Islamic world is defined by the principles of the Quran and is based on societal ideals, ethics, and morality, where money is considered solely as a means of payment and the services provided by banks are traditional, with minimal interest rates. There is a direct prohibition on banks investing in so-called "virtual assets," particularly derivative securities, which eliminates the likelihood of financial bubbles occurring. [1, p.11].

Ethical approaches in banking are also prevalent in countries dominated by Christianity. For example, on October 13, 2020, a conference titled "Five Years after the Encyclical Laudato Si'. Ethical Investments for a Sustainable World" took place in the Vatican. Conference participants discussed the interplay between finance and ethics, as well as responsible investment [24].

It is worth noting that ethical banking involves negative screening, which entails refusing to provide credit for certain types of activities. For instance, after signing an agreement with the International Finance Corporation, Ukreksimbank is obligated to adhere to a set of prohibitions on financing specific industries, such as the production and sale of strong alcoholic beverages, atomic energy, coal industry, as well as companies engaged in activities related to the military sector.

For many years, financial institutions and investors have avoided investing in the defense sector in order to avoid tarnishing their reputation with arms trading. However, the Russian aggression against Ukraine has changed this approach. For example, the Swedish group SEB, which includes the largest bank in the Scandinavian region, made a decision a year ago to invest based on the principles of environmental and social sustainability and to ignore "defense" companies. However, on March 2, 2022, SEB reversed this decision and started allowing its funds to buy shares in arms manufacturers and "defense" sector companies.

The new format of banking, which involves obtaining economic benefits while simultaneously achieving social and environmental effects, is also known as alternative banking. The alternative nature lies in the fact that a bank expands the criteria of its effectiveness and goes beyond the pursuit of profit maximization, directing financial resources towards sustainability. For example, in the banking sector of Germany, "green" banks are considered to be alternative financial institutions that invest in environmental protection, rational resource utilization, support for agriculture and the production of organic products, as well as ensuring a high level of transparency in financial operations and social responsibility towards clients and employees. The number of clients of "green" banks is small but tends to grow. According to experts' estimates, already 3 million residents of Germany are using their services.

The first manifesto of the readiness of banking institutions to promote the implementation of sustainable development principles through the voluntary integration of social and environmental standards into their policies can be considered the year 2003, when 10 leading banks in the world (*Barclays, Citigroup Inc, The Royal Bank of Scotland, Rabobank, Westpac Banking Corporation, etc*.) approved

social and environmental guidelines for lending and project financing, known as the "Equator Principles" (EPs). These principles are a compilation of recommendations for project financing assessment, management of social and environmental risks, and applied to construction projects with a volume of over $10 million.

The essence of the "Equator Principles" is to ensure that projects financed by banks are developed and implemented based on social responsibility and in accordance with sound environmental management. If the borrower does not comply with the principles of the Equator, the financial institution (project creditor) may refuse or terminate financing if the project is already underway [8]. Essentially, the "Equator Principles" initiated the development of socially responsible banking. Thanks to EPs, banks that finance large projects become stakeholders, taking on a share of responsibility for the impact of these projects on the environment and society.

As of 2021, 118 financial institutions in 37 countries, corresponding to EPs, have officially agreed to review their portfolio of loans in the field of international project financing in both developed and developing markets [20].

The Sustainable Banking and Finance Network (SBFN) was established in 2012 as a platform for knowledge sharing and capacity building in sustainable finance. SBFN is a voluntary association of central banks, financial sector regulators, and industry associations that support the priorities of sustainable finance for national development, expansion of the financial market, and stability. SBFN's approaches are based on best international practices that reflect national context and priorities. The International Finance Corporation (IFC), a private sector arm of the World Bank Group, serves as the Secretariat of SBFN, providing strategic and technical advice. The goal of the network is to enhance environmental, social, and corporate governance in the banking sector and promote financial market development.

The National Securities and Stock Market Commission of Ukraine (NSSMC) officially joined SBFN in July 2020. SBFN and IFC are working with NSSMC on developing a roadmap for sustainable finance, establishing a regulatory framework, and providing methodological support for the development of green and climate finance products [15].

Another significant step towards the development of responsible banking was the signing on September 22, 2019, by 130 banks worldwide of the first-ever agreement for the banking sector: the UN Principles for Responsible Banking. The signatories committed to align their business strategies and practices with the sustainable development goals defined by the UN General Assembly in 2015 and the goals of the Paris Climate Agreement. Within a year, the number of participants increased to nearly 200 banks, collectively serving over 1.6 billion clients worldwide and accounting for approximately 40% of global banking assets. The Principles of Responsible Banking provide the foundation for a resilient banking system and help the industry demonstrate how to make a positive contribution to shaping a sustainable future.

The first official Ukrainian participant of the Principles for Responsible Banking in 2019 was UkrGasBank. As early as 2015, UkrGasBank chose environmental

sustainability as a priority for its development. Recognizing the potential in energy efficiency and renewable energy, the bank introduced a range of banking products alongside traditional financing options that were profitable for the bank, beneficial for the clients, and environmentally friendly. The International Finance Corporation (IFC), with whom UkrGasBank signed a three-year agreement in 2016, provided expert advice and assistance. UkrGasBank established a technical-engineering office to provide comprehensive expert and professional assessments. Specialists are able to calculate all environmental parameters, CO_2 emissions, and energy efficiency savings [22].

The National Bank of Ukraine is also not indifferent to global trends. In November 2020, the NBU presented the "Policy for Sustainable Financing Development until 2025." This document was developed in cooperation with the International Finance Corporation (IFC) and aims to promote sustainable financing in Ukraine. It contains a detailed description of the tasks and tools for bringing the activities of Ukrainian financial institutions closer to the best global standards of integrating environmental, social, and governance criteria (ESG) into financial services.

As stated in the document, the Policy is an integral part of the global, European, and national trend towards sustainable development. The objectives of the Policy include:

- promoting sustainable economic development in Ukraine;

- popularizing environmental awareness and social responsibility in the financial sector of Ukraine;

- assisting financial institutions regulated by the National Bank of Ukraine in adhering to environmental goals, principles of sustainable economic activity, and the principle of energy efficiency as a priority, as defined in the European Green Deal [16, p. 7].

The approved NBU Policy applies to both the banking and non-banking sectors. Thus, the regulator has created conditions for banks to incorporate sustainable practices and responsible approaches in banking to promote sustainability. Ensuring sustainable development beyond the realm of social responsibility is impossible.

In June 2022, Ukraine received an assessment of progress in sustainable financing. The SBFN Report noted that in 2021, thanks to the adoption of a series of policies and recommendations, Ukraine created a system/concept of sustainable financing. It is also recognized that in Ukraine, "there is a national system to facilitate the flow of financial resources to green, climate, social projects and projects related to sustainable development, and activities aimed at increasing awareness and strengthening the potential for financing sustainable development measures are underway" [13, p. 8].

The aforementioned features of banking in one way or another contribute to sustainability, by considering the environmental and social impacts of their activities and implementing moral and ethical principles. These principles will be of utmost importance during the reconstruction of Ukraine. It is already evident that banking

institutions in post-war Ukraine will have to operate under exceptionally challenging conditions, with one-third of the country's economy destroyed (as of 2023, GDP has decreased by over 40%), a sharp increase in poverty among the population, and an inefficient foreign exchange market, among other issues. The National Recovery Plan [14] has defined the basic principle of post-war reconstruction as "Build Back Better." This principle is also one of the key terms in the World Bank's RDNA2 report (assessing Ukraine's needs for rapid recovery) - an important document for assessing Ukraine's losses from the war and its recovery needs. This principle specifically involves reconstruction with the fullest consideration of the environmental factor and the use of a value-based approach to investments.

Taking into account the specific nature of banking activities and based on the principles of sustainable banking, Ukrainian banks can act as follows in the conditions of post-war Ukraine. Implement sustainable banking principles in their operational activities: direct credit resources towards investment projects of companies with high ESG indicators. For example, reduce the interest rate for borrowers who invest in resource-saving technologies and employ vulnerable segments of the population (displaced persons, people with disabilities, women, etc.).

Review their own deposit and lending policies. For example, consider the ability to repay mortgage loans for individuals who have lost their homes or loans for businesses that have been destroyed due to Russian bombings, and engage in responsible lending.

Activate social policies towards their employees and be prepared to make social investments in personnel, including payment for training and education, and providing psychological support to employees. Be ready to implement diverse CSR programs, especially community assistance programs in areas of business presence and corporate volunteering.

The main tool for implementing sustainable development goals is sustainable finance. The concept of sustainable finance is based on considering environmental, social, and managerial factors in economic activity or investment projects. Sustainable finance is best implemented in banking activities, in the form of socially responsible banking.

Banking based on principles of social and environmental responsibility is capable of significantly influencing sustainable development. Modern banks can become catalysts for achieving sustainable development goals by redistributing financial resources based on responsible banking principles. This will contribute to the formation of a sustainable economy by directing credit and investment resources to types of economic activities that will bring the best return from a societal standpoint.

Support for sustainable development principles is becoming part of banking strategies and corporate governance. Ukrainian banks are gradually and systematically incorporating sustainability guidelines into their operations, transforming banking. The focus on ensuring sustainability and greening the

economy will be particularly relevant during Ukraine's post-war recovery, helping to fulfill the fundamental principle of "building back better than before."

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14. ARTIFICIAL INTELLIGENCE: IMPORTANCE, OPPORTUNITIES AND DEVELOPMENT POTENTIAL IN BUSINESS

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The recent breakthrough in artificial intelligence development has opened up new opportunities for optimizing business processes. AI allows automating routine tasks which increases productivity and improves the quality of decision-making. Consider the role of AI in the business environment and its impact on various aspects of organizational activity.

1. Process automation.

One of the main advantages of using AI in business is the possibility of automating routine and repetitive tasks. AI can be used to work with data, process

text, detect patterns, analyze large volumes of information, and much more. This allows employees to be relieved from monotonous tasks and direct their attention towards more complex and strategic tasks.

2. Improving decision-making.

The use of AI can significantly improve the decision-making process in business. Analytical AI algorithms can collect and analyze large volumes of data from various sources and find additional connections inside. These findings open up ways for more objective and accurate forecasting, which contributes to better decision-making and reduces risks.

3. Data and customer management.

AI can be used to improve data and customer management. Automatic data processing and analysis help to find valuable information, hidden patterns, and new business opportunities. In addition, AI can help in developing a personalized interaction with customers, predict their needs and provide recommendations.

A lot of modern businesses pin their hopes on opportunities that artificial intelligence can bring in the near future. This is evident from the answers to the question "How do you think AI will improve business indicators of companies' activities in the next 5 years?": 90% of respondents believe that AI development will result in the expansion of the business, 86 % — in productivity growth; 84% — in an increase in innovations; 69% — in an increase in job opportunities. Working with artificial intelligence, and its implementation in the company's activities requires an understanding of terms and abbreviations accepted in global practice (Table 1).

Table 1 — Terms and abbreviations related to artificial intelligence

Term	Abbreviation
Artificial Intelligence	AI
Artificial General Intelligence — representation of generalized human cognitive abilities in software so that the system helps to find solutions	AGI
Machine Learning	ML
Deep Learning — is a method of artificial intelligence that teaches computers to process data in a way similar to the human brain.	DL
Natural language processing — the general direction of computer science, artificial intelligence, and mathematical linguistics	NLP
Computer Vision	CV

There are generative and personalized AI.

Generative artificial intelligence (GAI) is a subfield of artificial intelligence that deals with the creation of models and systems capable of generating new content, such as texts, images, music, and other forms of data in response to special user requests — prompts (Prompt — free description of the task, which artificial intelligence should achieve.)

AI can analyze large volumes of data by using deep neural networks and machine learning, learn their dependencies and structures, and then generate new examples similar to those used during training.

The main functions of generative AI include:

✓ Content generation. GAI can create new content that meets the given rules and structures. For example, it can generate texts, articles, poetry, program code, etc. It can also create new images, music, videos, and other media files.

✓ Filling in the blanks. GAI can fill data gaps or continue the topic, delivering logical and understandable content. This can be useful for auto-completing sentences, expanding short descriptions, or supporting user input.

✓ Generation of variations. GAI can generate variations on a given theme or a given set of data. For example, it can create different designs, melodies, or stories with the same context.

✓ Automatic image generation. GAI can generate an image based on given input parameters, such as a description or sketch. This can be useful for creating illustrations, graphics, or designs automatically.

✓ Simulated Voice Synthesis: GAI can create realistic voice simulations that sound like real people. This can be used to create audio content, audiobooks, virtual assistants, etc.

✓ Generation of videos and animations: GAI can generate new videos and animations based on given parameters. It can generate moving objects, special image effects, and other visual elements.

The use of generative AI has a lot of potential for many fields, including art, design, media, advertising, gaming, scientific research, and many others. However, caution should be exercised when using GAI, as it can also generate false information and manipulate content.

Personalized artificial intelligence (AI) refers to systems that are designed to provide personalized services and support the user in various aspects of their daily life. It can have different functions depending on its capabilities. Here are some common features that can be included in a personalized AI:

✓ Intelligent assistant. Personalized AI can act as a virtual assistant that answers user questions, provides information, and performs various tasks. It can be an application on a smartphone, a voice assistant, or built into other devices.

✓ Speech recognition. A personalized AI can have a speech recognition function that allows it to understand and interpret the user's voice commands. This allows you to interact with the system using voice commands, without the need to type text.

✓ Personalized recommendations. Personalized AI can analyze user data such as interests, previous interactions, and preferences to provide personalized recommendations. For example, it can be video, music, article, product, or service recommendations.

✓ Calendar and organization. Personalized AI can have a calendar and organization function, helping the user to schedule meetings, remind about events, and manage tasks and reminders. It can sync with other devices and apps to keep information consistent.

✓ Pattern recognition. Personalized AI may be able to recognize objects, people, scenes, and other elements in images or videos. This can be used, for example, to automatically sort photos by objects or people in them.

✓ Data analysis and forecasting. Personalized AI can analyze available data and use machine learning algorithms to predict certain outcomes or behaviors. For example, it can provide recommendations on financial investments or predict weather conditions.

These are just a few examples of functions that can be implemented by personalized AI. Typically, these systems are designed to support and facilitate the user's daily tasks, providing information and assistance in various aspects of life. Let's consider examples of tasks that are solved by personalized AI in everyday life: generation of various plans and ideas (travel, holidays, birthdays, weddings), quick explanation of complex topics of writing or code debugging, detection of errors in text, correction (Grammarly), simulation of a conversation with a fictional character (as a teacher), generate marketing texts, letters, greetings, letters of recommendation, generate images for blogs, presentations, etc.

The most developed and popular areas of work with artificial intelligence today are work with tabular, visual, and textual data, natural language processing, and image processing.

Work with tabular, visual, and textual data. Artificial intelligence (AI) can play an important role in working with tabular, visual, and textual data, including:

✓ Automation of data processing. AI can help automate routine spreadsheet tasks such as sorting, filtering, joining, and aggregating data. It can quickly search, classify, filter, and group large amounts of data, and quickly and accurately process large amounts of data, which allows speeding up work and reducing the possibility of errors. AI can detect anomalies and risks in data, allowing for more accurate and efficient data processing. It can automate data analysis processes through the identification of patterns, trends, and correlations;

✓ Analysis and forecasting. AI can use the processing of tabular data to uncover useful information, identify trends and dependencies, and predict future values. It can apply machine learning and statistics techniques to create models that can predict outcomes based on existing data, analyze historical data, and find patterns that help predict future results. For example, AI can help predict sales, market trends, stock prices, etc.;

✓ Retrieval and classification. AI can help find and classify text data, such as documents, articles, or messages based on content and context. It can recognize keywords, identify topics and relationships between documents, making it easier to find and organize information. Analyze and understand

text data, perform machine translation, extract information from texts (e.g. names, dates, addresses) and classify text documents. It can be used to automate customer inquiry processing, analysis of users' feedback, social media monitoring, and many other tasks related to text analysis;

- ✓ Visual data processing. AI can analyze and recognize visual data such as images or videos. It can detect objects, recognize faces, sort images into categories, recognize emotions, determine the size and shape of objects, and perform other visual information processing tasks. All of these can be useful for automating visual inspection processes or image analysis. AI can be used in such fields as medicine (for example, image-based disease diagnostics), security (detection of dangerous objects in video surveillance), and autonomous vehicles (recognition of road signs and obstacles).
- ✓ Recommendations and personalizing. AI can use data analysis to make recommendations to users or customers. For example, it may analyze users' purchases and other data concerning them to recommend products or services that are likely to be of interest to users. This can help improve personalizing and user experience.

Natural language processing. Natural language processing solves the following main tasks: classification of texts into categories, machine translation, question-answer systems, text generation, search for similar texts, token/word classification, summarization, or abbreviation of texts.

Image processing. It is easy to encode an image into a numerical representation, but it requires a lot of computation. Image processing solves the following main tasks: image classification into categories, semantic segmentation, object detection, and video processing.

The use of AI in business has certain features:

- ✓ Artificial intelligence systems are more difficult to develop when working alone — for implementation in business it is worth forming a team;
- ✓ Automating many AI tools requires skills and expertise in Data Science;
- ✓ Implementation of artificial intelligence systems is a costly and high-risk task (according to Gartner CDO Survey 2023, 69% of AI systems do not provide the necessary return on investment);
- ✓ The usefulness of artificial intelligence systems is determined by comparison with the current processes (baseline), which are already in use, or with a solution that is easy to implement;
- ✓ The effectiveness of artificial intelligence systems depends on the quality of the data (if the input data is incorrect, the output results will also be incorrect).

Artificial intelligence systems in business differ according to the field of business activity and solve tasks specific to it (Table 2). These are just a few examples of how AI/ML is working in different areas of business. These technologies are constantly developing and finding new applications in various spheres of human activity.

Table 2 — Artificial intelligence systems in business areas

The field of business	Artificial intelligence systems
Agribusiness	Companies in the field of agro-industrial complex use AI for monitoring the crops (cameras, drones); diagnosis of plant diseases (by analyzing photos); harvest prediction (analysis of weather, soil, etc.); pricing; robotization of harvesting systems.
Financial sphere	Financial institutions can use AI to: assess the client default risks or risks of terminating the use of the institution's services; prevent fraud or money laundering; estimate LTV (customer lifetime value) and develop priority communication; evaluate products and services of the institution.
Electronic commerce	Business entities that perform financial and trade transactions can use AI for recommender systems; sales forecasting and product procurement optimization; optimization of marketing costs based on their impact; predicting personal discounts or offers for customers and their communication channel.
Automobile industry	Automotive businesses use AI for the prediction of the demand for cars; preliminary detection of defects in spare parts; optimization of the machine-building production line; optimization of spare parts logistics, and prediction of delays in deliveries.
Health care	Healthcare institutions are using AI for smart procurement for hospitals; estimates of the number of patients and the length of hospitalizations, prediction of the optimal number of doctors; prediction of refusals/absence of the client from a visit to the doctor.
Sports and eSports	Companies in the sports industry are using AI for predicting ticket sales and dynamic ticket pricing; systems for improving player performance (monitoring indicators, building personal development plans); assessment and monitoring of prices for players on the market; detection of foul play in online games.
Personalized recommendations	Companies like Netflix, Spotify, Amazon, and YouTube are using AI/ML to analyze large amounts of data about user behavior. Based on this analysis, they create personalized recommendations of products, videos, music, and other content for their users.
Medical diagnostics	Medical companies are using AI/ML to develop diagnostic algorithms that help detect and differentiate diseases at an early stage. Images from medical scans (such as X-rays and MRIs) can be analyzed with AI to look for pathologies.
Autonomous cars	Companies working on the development of autonomous cars use AI/ML to analyze data from sensors and cameras to control the vehicle without the driver, making them safer and more efficient.
Logistics and supply management	Companies operating in logistics are using AI/ML to forecast demand, optimize delivery routes, improve inventory, and automate processes.
Intelligent chatbots and customer service	Companies can use AI/ML to create intelligent chatbots that can automatically interact with customers, answer questions, solve problems, and provide 24/7 support.

Implementing AI in business faces some challenges, such as data privacy issues, ethical issues, and insufficient staff training. However, the benefits of using AI in a business environment far outweigh these challenges. AI can increase efficiency, reduce costs, improve product and service quality, increase competitiveness, and ensure business growth.

Since artificial intelligence is constantly developing, its application in business has great potential in the future. Areas of development of the use of AI in business include:

1. Deep learning. Deep learning is one of the key approaches in the field of artificial intelligence. This technology allows AI to analyze and understand complex patterns and relationships in data. Applying deep learning can help identify new opportunities, provide more accurate predictions, and take a step forward in improving business processes.

2. Advanced data analysis. Artificial intelligence can improve analytical processes in business. From standard data mining techniques to natural language processing, image processing, and voice recognition, AI can provide deep insight into data to drive better-informed decisions and customer understanding.

3. Intelligent assistants and virtual agents. The use of intelligent assistants and virtual agents can improve communication with customers and provide personalized service. AI can interact with customers through various communication channels, solve their problems and provide recommendations, all of which improve service quality and customer satisfaction.

4. Robotization of processes. Artificial intelligence combined with process robotics can automate not only routine tasks but also more complex business processes. This will ensure efficiency and productivity in production, logistics, and customer service.

5. Use of AI in product development. Artificial intelligence can be used to improve the process of developing products and services. From market and competitor analysis to demand forecasting and assessing the impact of new features, AI can help businesses develop more innovative and successful products.

The use of AI will cause changes in positions and roles for which businesses must be ready. These changes will require analysts and data scientists; specialists in artificial intelligence and machine learning; general and operational management managers; software and application developers and analysts; big data specialists; specialists in digital transformation and new technologies. At the same time, the following positions may disappear: data input workers; bookkeeping and payroll accountants; administrative and executive secretaries; workers for the collection of information about customers and customer service; managers of business services and administration; accountants and auditors; material accounting and warehouse management workers; managers of general and operational management; employees of the postal service.

For the successful implementation of AI in the business environment, several recommendations should be considered:

1. Assessment of needs and opportunities. It is important to analyze business processes and determine which specific tasks can be optimized or automated with AI. It is also important to consider the availability and quality of data, as well as the resources needed to implement AI.

2. Selection of appropriate AI technology. The AI market offers a variety of solutions and tools. When choosing an AI technology, one should take into account the specifics of the business, the scope of the project, and the available resources. Careful research and verification of the capabilities of various technologies will help to make the optimal choice.

3. Data quality assurance. Data is the basis for the successful functioning of AI. It is important to organize and clean data before using it in AI models. Carefully checking the accuracy, completeness, and relevance of the data will help to avoid inaccurate results and wrong decisions.

4. Ethical issues and security. When using AI in business, it is important to consider ethical aspects such as data privacy, protection of personal information, and transparency in the use of AI. It is also important to have plans in case of problems or errors in the operation of the AI system.

5. Staff training. Integrating AI into businesses requires education and staff training. Users of an AI system must have sufficient knowledge and skills to effectively use AI tools. Educational programs and training can be used to increase the competence of the staff.

Compliance with the described recommendations will allow businesses to effectively use the potential of artificial intelligence and ensure successful development in the modern digital environment.

Artificial intelligence systems implement specific functions and solve practical tasks in business. The main areas of use of artificial intelligence today are: work with tabular, visual, and textual data, natural language processing, as well as image processing. Artificial intelligence is an area of intensive research and significant investment. The development of artificial intelligence opens up new business opportunities. At the same time, the implementation of artificial intelligence has its limitations and peculiarities. Taking them into account will lead to a significant increase in the efficiency of companies — expansion of activities, increase in profitability, productivity and customer orientation, etc.

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15. RESHAPING FINANCE THROUGH AI: NAVIGATING TRANSFORMATION FOR SUSTAINABLE GROWTH

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The financial industry finds itself at a pivotal crossroads in an era characterised by rapid technological advancements and a growing emphasis on sustainable practices. The convergence of artificial intelligence (AI) and finance has ignited a transformative journey that promises to reshape the way financial systems operate while enabling a sustainable and inclusive approach to growth. This article delves into the dynamic interplay between AI and the finance sector, exploring how this powerful fusion drives unprecedented changes and propels the industry toward a future marked by sustainable growth and innovation.

With its intricate web of institutions, transactions, and decision-making processes, the traditional finance landscape is profoundly evolving thanks to the infusion of AI technologies. From revolutionising investment strategies to enhancing risk assessment methodologies, AI is permeating every facet of finance, injecting efficiency, accuracy, and adaptability into systems that were once reliant on conventional methods. As these technologies become more sophisticated, they offer financial institutions and market participants the tools to navigate complex challenges and align their practices with the global imperative of sustainability.

Amid the push for sustainable practices in all sectors, the finance industry stands out as a critical player that can influence real-world change. Adopting AI-driven solutions presents an opportunity to integrate environmental, social, and governance (ESG) considerations into financial decision-making processes. By harnessing the power of AI, financial institutions can analyse an unprecedented volume of data and gain previously inaccessible insights, thereby fostering a more comprehensive understanding of the impacts of investments and strategies on long-term sustainability.

However, this transformative journey has its challenges. Ethical considerations, potential biases in algorithms, data privacy concerns, and the need for regulatory frameworks to keep pace with technological advancements are among the complex issues that demand careful navigation. However, these challenges outweigh the potential benefits. Collaboration between the financial sector and the tech industry and a commitment to responsible AI implementation can guide the path toward a more resilient, adaptable, and sustainable financial landscape.

In the pages that follow, we will embark on a comprehensive exploration of the intricate relationship between AI and finance. We will examine how AI reshapes risk assessment, revolutionises investment strategies, enhances customer experiences, and aids regulatory compliance. Through this journey, we aim to uncover the transformative potential of AI in reshaping finance for sustainable growth while shedding light on the considerations that will define the responsible integration of AI in the financial world.

Cockburn proposes that the rapid strides taken in artificial intelligence have substantial implications for both the economy and society. These technological innovations wield the power to influence the creation and attributes of an extensive array of products and services. This, in turn, can reverberate through productivity, employment, and competition. However, AI's impact does not confine itself to these immediate outcomes alone. It can trigger a profound transformation in the essence of the innovation process, a shift that could carry consequences of equal weight. Over time, these consequences might even surpass the direct effects of AI, taking on a more dominant role [7].

Automation denotes the replacement of human tasks by machines, while augmentation involves a close collaboration between individuals and machines to achieve objectives. From the perspective of Raisch and Krakowski, the emphasis for organisations should lean toward augmentation due to its association with heightened performance levels. Even with this, they contend that augmentation can be partially disentangled from automation within the realm of management. To navigate this terrain, organisations can garner synergies and alleviate tensions by adopting a broader outlook encompassing augmentation and automation. This approach ultimately yields advantages for both the business landscape and society. Thus, leaders in management ought to take an active role in delving into the operational dynamics of AI within organisational contexts [8,9].**

In the contemporary business landscape, organisations encounter a multitude of obstacles. Traditionally, globalisation held a position of paramount significance. However, the tides have shifted with the advent of novel technologies, accompanied by their inherent advantages and risks. The velocity of technological evolution is such that organisations must consistently refresh their toolkit and adopt modern methodologies to retain their competitive edge. In this context, the call is for organisations to embrace adaptability and resilience as they confront these challenges, a strategic stance crucial for thriving amidst the currents of the present business environment. While artificial intelligence (AI) undeniably offers the potential to assist organisations in tackling some of the hurdles they encounter today, it is essential to acknowledge that it is not a universal remedy.

Mitigating Organisational Challenges:
In today's dynamic business world, organisations face many challenges that demand strategic solutions for sustained growth and success. Fortunately,

organisations can adopt several potential approaches to address and mitigate these challenges effectively.

Strategic Partnerships: Collaborative efforts through partnerships can provide organisations with access to complementary expertise and resources. Organisations can tap into a broader pool of knowledge and capabilities to tackle complex challenges more effectively by forming alliances with other businesses, research institutions, or technology providers. Agile Adaptation: The ability to swiftly adapt to changing circumstances is critical in modern business environments. Adopting an agile mindset and organisational structure enables companies to pivot rapidly, experiment with new approaches, and adjust strategies based on real-time feedback.

Data-Driven Decision-Making: Harnessing the power of data analytics and insights can enhance decision-making processes. By collecting and analysing relevant data, organisations can gain valuable insights into market trends, customer preferences, and operational inefficiencies, enabling informed choices that drive positive outcomes.

Employee Empowerment: Organisations can empower their employees by fostering a culture of innovation, continuous learning, and creativity. Engaged and motivated employees are more likely to proactively contribute ideas, solve problems, and drive organisational improvements. Technology Integration: Strategic integration of cutting-edge technologies, such as AI, automation, and blockchain, can streamline processes, enhance efficiency, and unlock new opportunities. Assessing the suitability of these technologies and aligning them with organisational goals is crucial for effective implementation.

Diversity and Inclusion: Embracing diversity in the workforce, perspectives, and ideas can lead to more robust problem-solving and innovation. Inclusive environments encourage collaboration, creativity, and a more comprehensive range of solutions to address challenges. Ethical Considerations: Addressing ethical concerns head-on is essential, especially in fields involving emerging technologies like AI. Organisations should establish clear ethical guidelines and frameworks to ensure their actions align with societal values and norms.

Customer-Centric Approach: Placing customers at the centre of decision-making processes can guide organisations in creating products and services that meet their needs. This approach enhances customer satisfaction and loyalty while also fostering brand growth.

Continuous Learning and Development: Prioritising ongoing training and development programs for employees to keep their skills relevant and up-to-date. A well-trained workforce is better equipped to handle challenges and capitalise on emerging opportunities. Sustainability Initiatives: Integrating sustainable practices into business strategies addresses environmental concerns and enhances long-term viability. Sustainable practices can improve efficiency, reduce costs, and enhance brand reputation.

In conclusion, addressing organisational challenges requires a multifaceted and adaptable approach. By combining these potential solutions and tailoring them to

specific circumstances, organisations can navigate uncertainties, seize opportunities, and achieve sustained growth in an ever-evolving business landscape.

While AI undoubtedly holds the potential to aid organisations in grappling with these hurdles, it is imperative to emphasise that AI is not a magical solution. Instead, it is a tool nestled within an organisation's repertoire, requiring harmonious integration with other strategies and approaches for optimal efficacy. Moreover, organisations must confront the ethical and privacy quandaries intertwined with AI deployment to ensure responsible and sustainable utilisation.

In the present landscape, sustainable change is paramount in tackling organisational challenges. Such sustainable change paves the way for consistent, reliable, and enduring business growth and showcases the business's adaptive prowess in the face of ever-evolving circumstances. This approach bolsters the business's reputation while ensuring astute risk management, fostering innovation and creativity through pioneering projects and endeavours.

Reasons to Address Sustainable Changes:

Embracing sustainable changes within an organisation is no longer a mere option; it has become a strategic imperative in today's global business landscape. The convergence of environmental, social, and economic considerations underscores businesses' need to initiate sustainable transformations proactively. Here are compelling reasons why organisations should prioritise and advocate for sustainable changes:

Enhanced Reputation and Brand Value: A commitment to sustainable practices enhances a company's reputation and brand image. Consumers, investors, and stakeholders increasingly value businesses prioritising environmental and social responsibility, leading to heightened trust and loyalty.

Risk Mitigation: Sustainable practices help mitigate operational, regulatory, and reputational risks. By proactively addressing environmental and social concerns, organisations reduce exposure to potential legal liabilities, fines, and negative public perception.

Innovation and Creativity: Embracing sustainability necessitates finding innovative solutions to complex challenges. This drive for innovation often leads to the developing of new products, services, and business models, fostering a culture of creativity and adaptability. Cost Savings: Many sustainable practices, such as energy efficiency measures and waste reduction, translate into cost savings over time. Lower resource consumption and optimised processes improve operational efficiency and financial performance.

Market Differentiation: Organisations prioritising sustainable practices can differentiate themselves in competitive markets. Sustainability becomes a unique selling proposition, attracting environmentally conscious consumers and partners.

Attracting Top Talent: The workforce of today seeks employment with purpose-driven organisations. Companies that demonstrate a commitment to sustainable practices are more likely to attract and retain top-tier talent who align with the organisation's values. Regulatory Compliance: Governments and regulatory

bodies increasingly enforce environmental and social regulations. Embracing sustainable changes ensures organisations remain compliant, avoiding penalties and disruptions to operations.

Long-Term Viability: Sustainable practices are inherently focused on long-term viability. Organisations that adapt to changing environmental and social dynamics are better equipped to navigate uncertainties, ensuring continued success.

Customer Demand: Consumer preferences shift towards eco-friendly and socially responsible products and services. Addressing sustainable changes allows businesses to align with customer expectations and capture new market segments.

Ecosystem Preservation: By adopting sustainable practices, organisations preserve ecosystems and biodiversity. This benefits the planet and supports the stability of supply chains and resource availability. Investor Interest: Sustainable practices are gaining traction among investors who recognise their potential to drive long-term financial returns. Companies with firm sustainability profiles often attract socially responsible investment and support. Future-Proofing: Anticipating and addressing sustainability challenges positions organisations to remain resilient despite evolving environmental, social, and economic shifts.

Global Goals Alignment: Sustainable changes align with international sustainability goals, such as the United Nations Sustainable Development Goals (SDGs). Contributing to these goals enhances an organisation's global impact and collaboration opportunities. In summary, addressing sustainable changes offers many benefits encompassing reputation enhancement, risk reduction, innovation, cost savings, and market advantage. It resonates with societal values, attracts stakeholders, and positions organisations as leaders in shaping a more sustainable future.

The Potential of AI to Drive Positive Transformation:

Artificial Intelligence (AI) stands at the forefront of a technological revolution with the potential to reshape industries and societies profoundly. As organisations grapple with complex challenges in today's dynamic environment, AI emerges as a transformative tool that can drive positive change across various domains. Here is a closer look at how AI holds the power to bring about positive transformations:

Enhanced Decision-Making: AI's ability to process and analyse vast amounts of data swiftly enables organisations to make more informed decisions. With AI-powered insights, businesses can uncover patterns, trends, and correlations that might not be apparent through traditional analysis methods.

Predictive Analytics: AI empowers organisations to predict future trends and outcomes based on historical data. This capability aids in proactive planning, risk mitigation, and seizing emerging opportunities.

Automation of Routine Tasks: AI-driven automation liberates human resources from mundane tasks, enabling them to focus on higher-value activities that demand creativity, critical thinking, and strategic decision-making.

Personalised Customer Experiences: AI-driven data analysis enables organisations to understand individual customer preferences and behaviours. This

knowledge facilitates personalised marketing, customer service, and product recommendations, improving customer satisfaction and loyalty.

Efficient Operations: AI optimises processes, resource allocation, and supply chain management. This streamlines operations reduces waste, and enhances overall efficiency, resulting in cost savings and increased productivity.

Innovative Product Development: AI assists in creating innovative products and services by analysing market trends and consumer feedback. This promotes the development of offerings that are aligned with evolving customer needs.

Healthcare Advancements: In healthcare, AI aids in disease diagnosis, drug discovery, and personalised treatment plans. It can revolutionise patient care, improving outcomes and reducing costs.

Environmental Sustainability: AI can monitor and manage environmental data to support sustainable practices. It assists in optimising energy consumption, resource usage, and waste reduction, contributing to eco-friendly operations.

Education and Learning: AI-powered educational platforms offer personalised learning experiences. They adapt content and pace to individual students' needs, enhancing engagement and knowledge retention.

Urban Planning: AI can enhance urban planning by analysing data related to transportation, infrastructure, and population trends. This aids in creating more intelligent, more efficient cities.

Financial Services: AI-driven algorithms analyse financial data to predict market trends, manage risks, and optimise investment portfolios, contributing to more stable financial ecosystems.

Scientific Discovery: AI accelerates scientific research by processing and analysing vast volumes of data in genomics, astronomy, and materials science, unlocking new insights and discoveries.

Accessibility and Inclusion: AI can be harnessed to develop assistive technologies for individuals with disabilities, fostering greater inclusivity and enabling broader participation in various activities.

AI's potential for positive transformation is immense and spans across industries and sectors. However, it is essential to approach AI implementation with responsible ethics, transparency, and considerations for potential biases. By harnessing AI's capabilities, organisations can navigate challenges, capitalise on opportunities, and create a more efficient, innovative, and sustainable future.

The Impact of AI on Businesses:

Artificial Intelligence (AI) is not just a technological trend but a seismic force that is reshaping the business landscape in unprecedented ways. From automating routine tasks to uncovering insights from massive datasets, AI fundamentally alters how businesses operate, interact with customers, and strategies for the future. The impact of AI on businesses is profound and multifaceted, leading to transformative changes across various dimensions:

Automation and Efficiency: AI automates repetitive and time-consuming tasks, freeing up human resources to focus on higher-value activities. This streamlines

operations reduces errors, and enhances efficiency, leading to cost savings and improved productivity.

Data-Driven Decision-Making: AI's data analysis capabilities enable businesses to make informed decisions based on actionable insights. It sifts through vast datasets to identify trends, patterns, and correlations that guide strategic choices.

Enhanced Customer Experiences: AI enables personalised customer experiences by analysing individual preferences and behaviours. Chatbots, virtual assistants, and recommendation systems provide tailored interactions that improve customer satisfaction and loyalty.

Predictive Analytics: AI predicts future trends and outcomes based on historical data. Businesses can anticipate customer needs, market shifts, and demand fluctuations, enabling proactive planning and resource allocation.

Innovation and Product Development: AI aids in product innovation by analysing market feedback and identifying gaps. It assists in designing products that resonate with customer preferences, ensuring relevance and a competitive edge.

Supply Chain Optimisation: AI optimises supply chain management by predicting demand, identifying bottlenecks, and managing inventory levels. This reduces costs, enhances reliability, and ensures smoother operations.

Marketing and Advertising: AI refines marketing strategies by analysing customer behaviour and preferences. It facilitates targeted campaigns, personalised content delivery, and accurate audience segmentation.

Risk Management: AI assesses risks by analysing historical data and market trends. It aids in managing financial risks, fraud detection, and compliance with regulations, enhancing overall business stability.

Human Resources and Talent Management: AI assists in talent acquisition, screening resumes, and identifying suitable candidates. It also aids in employee retention by predicting potential turnover factors.

Competitive Advantage: Businesses that leverage AI gain a competitive edge by adapting faster to market changes and customer demands. They can stay ahead by delivering innovative products and services.

Operational Insights: AI-powered analytics provide deeper insights into operations, helping identify areas for improvement and efficiency enhancement.

Customisation and Personalisation: AI enables mass customisation, tailoring products and services to individual preferences, creating stronger customer connections.

Regulatory Compliance: AI ensures compliance by automating data monitoring and reporting, reducing non-compliance risk and associated penalties.

Global Expansion: AI aids in language translation, cultural analysis, and customer engagement across diverse markets, facilitating global business expansion.

Ethical Considerations: As AI advances, businesses must navigate ethical considerations surrounding data privacy, algorithmic bias, and transparency to maintain public trust.

AI's impact on businesses transcends individual processes; it permeates the core of operations, strategy, and customer engagement. To harness its potential,

businesses must embrace AI as a transformative tool, fostering a culture of innovation, adaptability, and responsible implementation.

AI-Driven Transformation in the Financial Industry: Navigating Change for Sustainability

The financial industry is experiencing a revolutionary upheaval, and at the heart of this transformation lies the integration of Artificial Intelligence (AI). As financial institutions navigate a landscape marked by complexities, uncertainties, and a growing emphasis on sustainability, AI emerges as a catalyst for change that can reshape the industry's foundation.

Enhanced Decision-Making: AI equips financial professionals with powerful data analysis tools, enabling them to make more informed and strategic decisions. By swiftly processing vast datasets, AI identifies trends, risk factors, and investment opportunities that would be challenging for humans to discern alone.

Risk Assessment and Management: AI revolutionises risk assessment by modelling scenarios and predicting potential risks based on historical data. This empowers institutions to manage and mitigate risks more effectively, leading to a more resilient financial ecosystem.

Personalised Services: AI-driven algorithms create personalised customer experiences, offering tailored financial products, investment advice, and support. This enhances customer satisfaction and loyalty, enabling institutions to build more meaningful relationships.

Fraud Detection and Security: AI enhances cybersecurity by identifying unusual patterns and behaviours in real time, thus fortifying the defences against fraud and cyber threats. This is crucial in maintaining the integrity of financial transactions and protecting sensitive data.

Algorithmic Trading: AI-powered algorithms are transforming trading strategies. They can analyse market data, execute trades, and adapt to changing market conditions faster than human traders, potentially increasing efficiency and minimising risks.

Regulatory Compliance: The intricacies of regulatory compliance can be overwhelming, but AI simplifies this process by automating data collection, analysis, and reporting, ensuring adherence to evolving regulations.

Sustainable Finance: AI contributes to sustainable finance by integrating Environmental, Social, and Governance (ESG) criteria into investment decisions. It assesses investments' environmental and social impacts, aligning financial strategies with long-term sustainability goals.

Operational Efficiency: AI streamlines back-office operations by automating data entry, reconciliation, and documentation tasks. This reduces operational costs and frees up human resources for more value-added activities.

Customer Insights: AI analyses customer behaviour, preferences, and feedback to provide insights that drive product development and service enhancements, enabling institutions to meet customer needs better.

Data Security and Privacy: While AI harnesses data for insights, it also emphasises the importance of robust data security and privacy measures to safeguard sensitive financial information.

However, the journey toward AI-driven transformation comes with challenges. Ensuring ethical AI use, managing potential biases, upskilling the workforce, and addressing regulatory concerns are among the hurdles to overcome. To navigate this path successfully, financial institutions must adopt a balanced approach that embraces innovation while prioritising security, transparency, and accountability.

As AI redefines the financial landscape, the industry has an unprecedented opportunity to steer towards a future marked by sustainability, efficiency, and improved customer experiences. By harnessing the power of AI, financial institutions can navigate change with agility and set a course for a more resilient and prosperous future.

Integrating AI for Positive Transformation in the Financial Industry

The financial industry stands on the cusp of a transformative era, one propelled by Artificial Intelligence (AI) integration. This symbiotic relationship between AI and the financial sector promises to revolutionise operations, customer experiences, risk management, and sustainability initiatives. By seamlessly weaving AI into the fabric of financial processes, institutions can steer toward positive transformation and lead the industry into a new era of innovation and efficiency.

Enhanced Decision-Making: AI augments the decision-making prowess of financial professionals by analysing vast and intricate datasets at speeds unattainable by humans alone. This empowers them to make more accurate predictions, optimise investment strategies, and confidently navigate market volatility.

Personalised Customer Experiences: AI tailors financial services to individual customers, understanding their preferences, behaviour, and needs. This fosters deeper connections, boosts customer loyalty, and positions financial institutions as trusted partners in their clients' financial journeys.

Risk Management: AI redefines risk management by swiftly assessing data for potential threats, fraudulent activities, and market fluctuations. Its predictive capabilities provide institutions with insights to adapt and develop proactive risk mitigation strategies.

Algorithmic Trading: AI-driven algorithmic trading optimises execution, adapting real-time strategies based on market conditions. This maximises efficiency and reduces human biases, potentially leading to improved returns.

Regulatory Compliance: The intricate web of regulations can be navigated more effectively with AI-powered automation. Institutions can ensure compliance by automating data analysis, documentation and reporting, thus reducing the risk of non-compliance penalties.

Sustainable Finance: AI aids sustainable finance by evaluating investments through Environmental, Social, and Governance (ESG) lenses. It identifies opportunities that align with sustainable principles, contributing to responsible and impactful investment decisions.

Operational Efficiency: By automating routine tasks and processes, AI streamlines operations and minimises errors. This results in cost savings and improved operational efficiency, allowing human resources to focus on more strategic tasks.

Fraud Detection: AI's pattern recognition capabilities bolster fraud detection systems, swiftly identifying anomalies and suspicious activities. This fortifies cybersecurity, safeguarding transactions and sensitive information.

Data Analysis: AI's prowess in analysing complex data sets enables institutions to gain insights into customer behaviour, market trends, and performance metrics. These insights inform strategy development, allowing institutions to remain agile and adaptable.

Continuous Learning: AI evolves with time, learning from its experiences. This iterative process enables financial institutions to adapt to changing market dynamics, refine strategies, and stay ahead of competitors.

However, successful integration of AI necessitates addressing ethical concerns, transparency, data privacy, and human-AI collaboration. Institutions must foster a culture that embraces AI as a tool for positive change while emphasising ethical deployment and human oversight.

The fusion of AI and the financial industry heralds a transformative journey with the potential to enhance efficiency, customer experiences, and sustainability practices. By harnessing AI's capabilities, financial institutions can drive positive transformation, navigate challenges, and pioneer innovation, cementing their role as pioneers in the modern financial landscape.

In the intricate tapestry of the financial industry, the infusion of Artificial Intelligence (AI) threads a narrative of remarkable transformation. The marriage of cutting-edge technology with financial expertise has given rise to a new chapter marked by efficiency, innovation, and a resolute commitment to sustainability. As we conclude this exploration of AI-driven change, it is evident that the path ahead holds immense potential and opportunity.

AI's role as a catalyst for positive transformation in finance is undeniable. From optimising decision-making processes to creating personalised customer experiences, from revolutionising risk management to fostering sustainable investments, AI's reach extends across every facet of the financial sector. It empowers organisations to navigate complexities, adapt to market dynamics, and embrace a future that thrives on innovation.

However, the integration of AI also demands a balanced perspective. Ethical considerations, transparency, and responsible AI deployment are paramount to ensure that the benefits of AI are harnessed while minimising risks. Collaboration between human expertise and AI's analytical power is the cornerstone of this transformative journey.

As the financial industry continues to evolve, embracing AI as an enabler of positive change has the potential to reshape the industry's narrative. It empowers financial institutions to serve their customers with unprecedented precision, manage

risks with greater insight, and drive investments that align with the imperatives of sustainability.

Ultimately, the journey toward a future shaped by AI is not a solitary endeavour. It requires collaboration, adaptability, and a shared commitment to harnessing AI's capabilities for the betterment of the industry and society. As AI and the financial industry evolve hand in hand, we stand at the threshold of a new era—one defined by innovation, resilience, and a steadfast pursuit of sustainable growth.

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16. DIGITALIZATION IN THE SYSTEM OF SUSTAINABLE TOURISM DEVELOPMENT INDICATORS

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The role of tourism in the economy of countries is growing at a fairly rapid pace and creates not only positive, but also negative impacts – economic, socio-cultural and environmental. That is why the sustainable development of tourism is becoming a priority for all subjects of tourism. After all, these negative impacts need to be minimized, and positive ones, on the contrary, should be strengthened. Sustainable tourism means "tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment, and host communities" [11].

In recent years, digitalization has been increasingly used as an effective tool for achieving sustainable development goals, including in tourism. That is why such new types of tourism as e-tourism, smart tourism and sustainable tourism have emerged.

Digital solutions can indeed improve the communication and management of resources and impacts in tourism, thereby facilitating sustainability [2]. The digital economy is changing the way of communication with tourists and the way of providing tourism services and improving the tourist's experience [1]. However, the use of these tools by tourism destinations may also face challenges, such as data privacy. Therefore, it is very important to correctly assess the possibilities of implementing digitalization to achieve sustainable development. It can be said that the integration of digital technologies must be performed in a sustainable way to avoid negative impacts on the environment and local communities.

Literature review.
Sustainability and digitalization are key areas of research in the tourism industry but intersection between them in tourism destinations is a relatively new research area that has received growing interest in recent years [2].

Some authors propose the concept of a digital ecosystem as a self-organizing socio-technical system of heterogeneous participants (enterprises, organizations, developers, consumers). They are united by common platform and focused on the potential for achieving synergy to create a digital end-user service or innovation. Implementation of such a system by tourism destinations will contribute to achieving sustainability [10].

Most studies of the digitalization of the tourism economy have focused on either business or consumer outcomes; much less attention has been paid to the implications for the Sustainable Development Goals, for example: tourism as an opportunity for "digital detox," the role of social networks in foodstagramming, virtual reality tours to explore tourist attractions from home, teaching simulations to improve learning about systems, big data analysis to determine prevalence of environmental interest, as well as regulatory demands on platforms to address principles of accountability, responsibility and transparency [7].

The use of digital technologies in tourism has led to the emergence of new forms of tourism, such as e-tourism, smart tourism, and sustainable tourism (Fig.1). E-tourism refers to the use of online booking platforms and digital marketing. Smart tourism refers to the use of smart technologies, such as Internet of Things (IoT) devices and artificial intelligence. Real-time data on tourist behavior and environmental conditions can be used to manage resources more effectively, reduce waste and minimize the negative impacts of tourism on the environment and host communities [2].
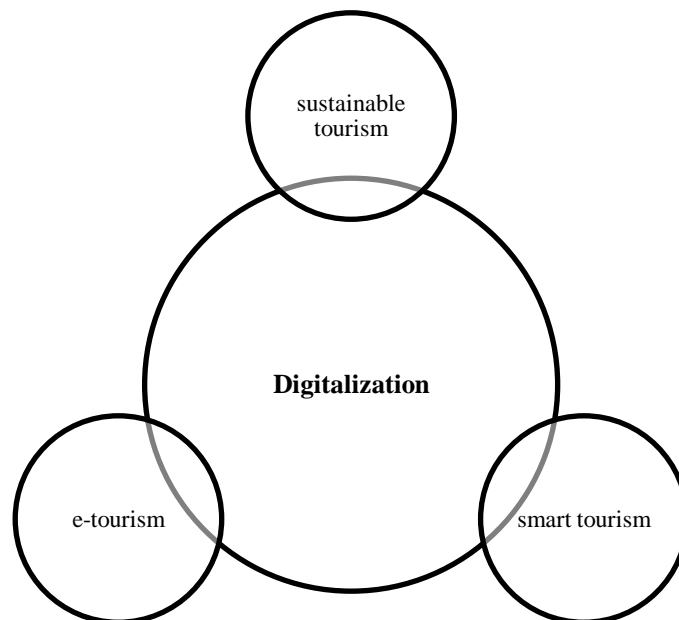
Figure 1. New types of tourism
Source: Developed by the author based on [2]

The main question of this research is how intersection between *digitalization and sustainability* can be measured. How can tourism destinations effectively use digitalization tools to achieve sustainable development goals? The answer to this question can be a system of indicators of sustainable tourism, which is being developed by various organizations. Famous methodological approaches to this issue are analyzed in this study for seeing direct mention of digitalization among the indicators of sustainable tourism.

Sustainable tourism indicators are proven tools for planning and managing sustainable tourism. This means that they are an essential element of the planning and management process. Indicators help to understand whether tourism in a

particular destination is sustainable or not. Sustainable tourism is tourism that adheres to the principles of sustainable development, such as economic efficiency, social justice and environmental protection. Therefore, the characteristics of sustainable tourism should evaluate all three goals of sustainable development.

Economic value indicators help to determine the contribution of tourism to the economic sustainability of a particular destination. Social and cultural impact indicators are used to measure the impact of tourism on residents and cultural heritage in a particular destination. Environmental impact indicators focus on those elements necessary for the sustainability of the natural environment for a particular destination.

The development of indicators for monitoring sustainability in tourism destinations needs to be based on a comprehensive systemic approach, which recognises interrelations between indicators and concentrates on enhancing systems and resilience thinking rather than on the interpretation of individual system variables [8].

Indicators can support informed decision-making at all levels of tourism planning and management:

National level: identify broad changes in tourism at the national level, compare with other countries, provide a basis for identifying changes at more local levels and support strategic planning at a broad level;

Regional level: as input to regional protection plans and processes, to serve as a basis for comparison between regions and to inform planning processes at national level;

Specific destinations (e.g. coastal areas, local municipalities and communities): to determine the key elements of assets, the state of the tourism sector, risks and efficiency;

Key tourism objects within destinations (e.g. beaches, historic areas within cities, areas of special interest): specific indicators can be key to decision-making regarding the control, management and future development of monuments (e.g. national parks, theme parks), where management-level indicators can support site planning and control;

Travel companies (e.g. tour operators, hotel, transport and catering companies): can access indicators to fuel the process of strategic destination planning;

Individual tourism businesses (e.g. hotels, restaurants, marinas): to monitor the impact and effectiveness of their work.

There are various models for evaluating sustainability through indicators, at different levels, global, national, regional, or local. At the municipal level, some examples of methodological tools for measuring sustainability can be referred to: the Ecological Footprint, the Sustainability Barometer, the Municipal Sustainable Development Index or the European Tourism Indicators System (ETIS), developed for the sustainable management of tourism destinations [9].

Results.

The Global Sustainable Tourism Council (GSTC) is an independent and neutral virtual organization legally registered in the United States as a non-profit organization representing a diverse and global membership, including national and provincial governments, leading tourism companies, hotels, tour operators, non-governmental organizations, individuals and – all strive to achieve best sustainable tourism practices.

The mission of GSTC is to be an agent of change in the world of eco-travel and tourism, contributing to the expansion of knowledge, understanding, perception and demand for sustainable tourism practices.

The GSTC criteria are global standards for sustainable development in travel and tourism. They are used for education and awareness raising, policy development for businesses, government agencies and other organizations, measurement and evaluation, and as a basis for certification.

The criteria are a minimum, not a maximum, that businesses, governments and countries must achieve in order to achieve social, environmental, cultural and economic sustainability. As each tourism destination has its own culture, environment, customs and laws, the criteria are designed to be adapted to local conditions and supplemented with additional location and activity specific criteria. They are the result of a global effort to establish a common languages regarding sustainability in tourism. The criteria are structured around four main principles [6]:

1. Sustainable management: effective management of tourism activities taking into account the principles of sustainable development.

2. Socio-economic consequences: support of fair working conditions, protection of workers' rights, promotion of social development and economic prosperity of local communities.

3. Cultural impact: preservation and support of cultural heritage, protection and promotion of local cultural values and traditions.

4. Environmental impact: reduce the negative impact on the natural environment, use resources efficiently, preserve biodiversity and landscapes, and reduce pollution.

The GSTC highlights industry criteria for the sustainable management of the private sector tourism industry, now focusing on hotels and tour operators and destination criteria for the sustainable management of destinations. In order to realize these criteria, indicators of success were introduced to help achieve the goal, answering the question "How exactly?". Thus, through them, the practice of sustainable tourism can become a standard measure in the context of a socio-economic development strategy. Due to limited resources, some criteria may not be adapted and become impossible to meet. However, these criteria are basic for the implementation of practice into reality.

In the report on GSTC criteria for destinations the words "digitalization" and "digital" are not mentioned. But "Climate change adaptation" criterion includes "Laws or policies to mitigate climate change and encourage technologies

to mitigate climate change" indicator, and "Energy conservation" criterion includes "Policies and incentives to reduce reliance on fossil fuels, improve energy efficiency, and encourage the adoption and use of renewable energy technologies". There is no clarification of which technologies and whether they are digital.

The methodology of *the World Tourism Organization* (UNWTO) provides a framework for assessing the approach to tourism in a country and the extent to which it is being pursued effectively as a tool for sustainable development. The framework is based around 5 Pillars. Each of the pillars has been broken down into a series of topics (sub-pillars) and issues. The 5 Pillars, 17 Sub-Pillars and 32 issues provide a basic agenda for assessing the situation in a country [12].

Pillar 1 "Tourism Policy and Governance" includes three sub-pillars: the position of tourism in development policies and programmes; tourism policy and regulatory framework; tourism governance and institutional setup.

Pillar 2 "Economic Performance, Investment and Competitiveness" consists of four sub-pillars: measuring tourism and its contribution to the economy; trade, investment and the business environment; brand, marketing and product positioning; resilience and risk management. Issue 1 "Clarity and focus of the brand and marketing plan" includes question "Is the current marketing activity making full use of new technology, social media and other e-marketing opportunities?" indicating the importance of digitalisation.

The UNWTO report also provides an example of project implementation within Pillar 2: "E-Tourism: Fostering Destination and Tourism SMEs Competitiveness through an ICT-centric networking" that includes Data Collector developed by UNCTAD (delivered within the package) which allows tourism standardized data gathering, and synchronisation with the Content Management System (OpenCMS) of the Electronic Tourism Platform. The Electronic Tourism Platform functional FOSS prototype is a first step towards a Destination Management System.

Pillar 3 " Employment, Decent Work and Human Capital" consists of two sub-pillars: human resources planning and working conditions; skills assessment and the provision of training.

Pillar 4 "Poverty Reduction and Social Inclusion" includes four sub-pillars: an integrated approach to poverty reduction through tourism; strengthening pro-poor tourism initiatives; the inclusion of disadvantaged groups in the tourism sector; the prevention of negative social impacts.

Pillar 5 "Sustainability of the Natural and Cultural Environment" includes four sub-pillars: relating tourism to natural and cultural heritage; focussing on climate change; enhancing sustainability of tourism development and operations; measuring and monitoring tourism impacts.

Another system of criteria has been developed by the European Commission – *the European Tourism Indicators System* (ETIS). ETIS is a scorecard that promotes sound tourism planning. These include [5]:

- a management tool that supports destinations wishing to adopt a sustainable approach to destination management;

- a monitoring system that is easy to use to collect data and detailed information and allows destinations to track their performance from year to year;

- an information tool (rather than a certification scheme) useful to policy makers, tourism businesses and other stakeholders.

ETIS provides basic guidance to guides and a clear explanation of what these indicators are and how to use them. This multi-toolkit complements the existing methodology at the international level.

It is used on a voluntary basis, as it allows individual areas to independently evaluate their activities, monitor, collect and analyze data. However, ETIS does not set mandatory minimum values that must be achieved and does not provide for certification. The indicators are based on 4 principles, similar to the GSTC criteria, but include economic value. The policy paper proposes a 7-step system for implementing and measuring sustainability in tourism:

1. Raise Awareness
2. Create a Destination Profile
3. Form a Stakeholder Working Group
4. Establish Roles and Responsibilities
5. Collect and Record Data
6. Analyse Results
7. Enable On-going Development and Continuous Improvement

Among the indicators of this approach, digitalization is not directly mentioned either.

The *EU Tourism Dashboard* is an online knowledge tool developed by the *European Commission*, aimed at promoting and monitoring the green and digital transitions and socio-economic resilience factors of the European tourism ecosystem.

The dashboard offers visualisations of tourism-relevant data and indicators collected from available, trusted sources concerning the tourism ecosystem, to allow the profiling and monitoring of the progress of EU countries towards the EU policy objectives. The indicators of the EU Tourism Dashboard are organised under three policy pillars: "environmental impacts", "digitalization", and "socio-economic vulnerability". In addition, the dashboard offers a set of "basic tourism descriptors" to provide further context regarding the characteristics of tourism destinations in terms of demand, supply and tourism offer. The dashboard currently covers all the EU27 Member States, Iceland, Norway and Switzerland, and targets decision makers and tourism managers to steer policies and strategies in the tourism ecosystem as the primary audience.

The digitalization pillar includes such indicators: enterprises using social media, e-commerce sales, internet speed at tourism destination, accommodations listed online, enterprises seeking ICT specialists and personnel training on digital skills (Fig. 2).
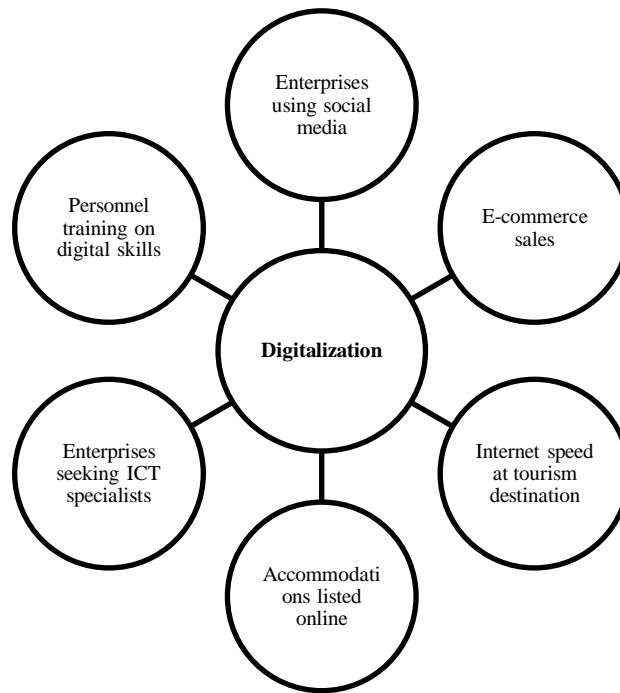
Figure 2. Indicators of digitalization policy pillar for tourism destinations
Source: Developed by the author based on the EU Tourism Dashboard [4]

Therefore, this methodology provides a clearer picture of the indicators of digitalization that can be taken into account to assess the progress of a destination towards sustainability. However, it should be noted that the list of these indicators may be much longer.

At the country level, *the Sustainable Travel Index* was launched by *Euromonitor International* to enable tourism businesses, destination management organizations (DMOs) and tourism boards to understand the challenges and opportunities for sustainable development by providing quantitative indicators across a range of components. This index can be used to compare performance with peers, develop a sustainable tourism strategy, interact with the UN Sustainable Development Goals, and positively impact all stakeholders [3].

Data collection and ensuring their quality and interstate compatibility is carried out with detailed definitions and the exact location of the data source. The data then goes through several levels of quality control and standardization. Any gaps in the time series are filled by statistical interpolation and expert opinion methods, followed by rigorous checks on data definitions and adherence to international classifications.

The data was obtained mainly from the Euromonitor Economies, Consumers, Travel and Sustainability Passport systems. An additional secondary study was conducted to collect data from the Global Happiness Report published by the Networked Solutions for Sustainable Development program, as well as the Griffiths University Global Sustainable Tourism Dashboard. In addition, Greenview provided three metrics for the hotel resource utilization category: full-service hotel energy, carbon footprint, and water use.

More weight was given to the demand for sustainable tourism, transport and housing as these have a strong and direct impact on a country's reputation for sustainable tourism and the ability to provide such products and services. Each country was analyzed along the seven key pillars of sustainable tourism.

The pillar of environmental sustainability is defined by environmental issues such as climate change, pollution and carbon emissions, as well as policy measures taken to protect and maintain biodiversity and the natural environment, the use of natural resources, dependence on fossil fuels and the introduction of renewable energy sources.

The pillar of social sustainability is defined by the quality of life and well-being of the population of the country based on the level of human rights, such as access to basic food and housing, the right to decent wages, equality and democratic freedoms provided by social policies.

The pillar of economic sustainability is defined as a country's ability to achieve economic growth, where tourism was cited as a means to achieve responsible consumption and production of Sustainable Development Goal 12, decent work and employment to eradicate poverty, democratize technology, and create a prosperous private sector.

The pillar of risk is defined as the main external risks in terms of human-made risks such as terrorism or natural risks such as natural disasters and climate events, the ability of a country to care for the sick, the level of population ageing, and the risks faced by natural and cultural values on which travel and tourism businesses depend.

The sustainable tourism demand pillar is defined as the ability of a country to provide a balanced and sustainable travel and tourism sector by creating a strong domestic tourism economy, avoiding over-reliance on over-tourism generating segments such as cruises, and finding the right balance between residents and visitors.

The pillar of sustainable transport is determined by the quality and energy efficiency of the transport infrastructure, the level of transport emissions, and the availability of different modes of transport and mobility options to avoid over-reliance on air travel.

The pillar of sustainable housing is driven by the use of full service hotel resources in the country and the diversity of the housing offer with a wide range of options such as short-term rentals, camping and traditional formats offered to consumers to ensure that there is no over-reliance on hotels.

These pillars look at 99 countries through the lens of environmental, social and economic sustainability, country risk, and demand for sustainable tourism, transport and housing. A total of 57 data points, each weighted according to a level of direct or indirect relevance, are used to arrive at the final index ranking for country comparisons.

Digitalization in the Euromonitor International report is present in pillar of economic sustainability, in particular, it mentions such indicators as percentage of population using the Internet and use of a mobile phone to access the Internet.

Therefore, despite the undoubted significant role of digitalization for the sustainable development of tourism destinations, popular systems of indicators of this development do not clearly formulate the involvement of digital tools in measuring one or another criterion. More often than not, the words "digitalization" and "digital" are not mentioned at all in the reports and manuals of well-known organizations developing a system of sustainable tourism indicators. Of course, this does not mean that digitalization is not taken into account by these organizations. But the vagueness of the wording can cause difficulties in planning and managing tourism destinations seeking to use digital solutions for sustainable development and who want these solutions not to create problems for the future development. Therefore, attention should be paid to possible indicators of digitalization for sustainable development of a tourism destination and their clear formulation in the popular systems of sustainable tourism indicators. Such indicators are offered, for example, by the new European platform "EU Tourism Dashboard".

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17. THE ROLE OF INFORMATION TECHNOLOGIES IN THE RESTORATION OF THE DOMESTIC TOURISM INDUSTRY IN THE POST-WAR PERIOD

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Informatization penetrates various spheres of human activity, including the tourism industry. The dynamics of global tourism development is driven by advances in scientific and technological progress, the use of computer simulations, the development of virtual reality, the promotion of mobile and Internet technologies, and the development of the IT sector. It is clear that the crisis caused by COVID-19 has become the largest for the global tourism industry and unprecedented in its consequences [10]. Compared to previous economic downturns, in this situation, the travel industry has experienced a complete lockdown. However, this has created new opportunities and allowed for the accumulation of a powerful potential of pent-up demand, and new opportunities for territorial tourism have opened up [2]. Countries, regions and territories wishing to increase tourist flows are forced to adapt to new customer demands and preferences, including through the use of information

technology. Ukraine's tourism industry is currently in a crisis phase of transformation caused by russia's military aggression. Undoubtedly, after the victory over the enemy, tourism will become a priority industry in the recovery of the national economy. In this regard, the use of information technology should play a significant role.

It should be emphasized that the global tourism industry is one of the most profitable sectors of the economic system of most countries in terms of its economic performance [1]. The tourism industry, characterized by outstanding successes and numerous specializations, has a strong impact on the transportation system (road transport, air transport, air transport) and the level of trade between different countries.

The complex of information technologies used at the current stages of progress in the global tourism industry consists of several elements in terms of structure and features: an automatic reservation system, video systems, coordination of information flows and a general system of electronic money transaction, etc. Today's information technology is an important component of the tourism industry. Advertising campaigns of travel companies are often posted on the Internet on various websites, thus attracting more and more attention of the audience [9]. Effective website operation is a basic component of any travel agency and cannot be carried out without the help of advertising. Personal computers and the Internet, being generally available modern technologies, are the specific factor that results in the introduction of new information technologies in all areas of tourism. Travel companies and travel agencies are using the full potential of the Internet information resource to modernize the reservation system. In other words, online bookings were pioneers in the field of electronic travel reservations, which, along with the development of the Internet, have become a powerful factor driving the development of tourism within the framework of modern information technologies. Thus, information technology has a significant role to play in the recovery of tourism.

The problems of functioning of the tourism industry in Ukraine during the crisis and after its end have been studied by such scholars as: Artemenko O., Pasichnyk V., Yegorova V. [1], Nosyrev O., Dedilova T., Tokar I. [8], Motsa A., Shevchuk S., Sereda N. [7], Zeid A. Kassouha [15], Bazhenova S., Polohovska Y., Bykova M. [2], Zaitseva V. [13], Bubley G. [14] and others. In general, the specifics of the use of information technology in tourism are revealed in the works of such scholars as: Vasilichev D., Gurova D. [11; 12], Pomaza-Ponomarenko A. [9], Harty I. [4], Belikova M., Pruss V. [3], Kuklina T. [6], Korniienko O. [10], etc. At the same time, the issues of the role and prospects of information technology in tourism for the post-war recovery economy remain unresolved. The vast majority of scientists in their research and scientific works have proved that the post-war recovery of the tourism industry determines the logical use of information technology. It is important to study the role and impact of information technology on the post-war development

of the tourism industry. The following methods were used in the study of this issue: generalization, theoretical and comparative analysis, abstraction.

An information resource is an objective and timely information that is necessary for running a tourism business, including information about the tourism market, customers, demand, supply, and other information [4]. The availability of complete and reliable information is a basic condition for doing business in tourism. Tourism enterprises are able to use the information resource productively in the post-war period and, under such conditions, can become market leaders and ensure the acceleration of tourism recovery and development. Those enterprises of the tourism industry that will actively implement and use modern information technologies will stimulate its development.

The development of the information environment should become the most important factor in tourism growth [5]. The post-war level of information technology development will significantly affect all aspects of the tourism business organization. In particular, Internet technologies have made it possible to manage in real time the objects of the tourism industry located anywhere in the world. This makes it possible to create fundamentally new types of organizations in the tourism sector, such as spatially distributed network structures, virtual travel agencies, etc. It is the information infrastructure that contains great potential for the development of the tourism business. The introduction of modern information technologies should ensure the fulfillment of a number of requirements, including: ensuring security through various methods of control and differentiation of access to information resources, support for distributed information processing, use of client-server architecture, availability of a convenient and friendly interface, modular principle of system construction, support for Internet technologies, etc [6].

Today, the main global travel trends include the following: 1) increasing the role of individual approach to the consumer in various areas of the travel industry; 2) continuous development of multimedia content and information technologies; 3) emergence of smart cities, locations, territories; 4) travel with benefits; 5) attention to eco-friendly routes. The global travel industry is undergoing fundamental changes related to technology [13]. Over the past decade, technology has significantly transformed the process of researching and booking travel services. Information technology has become the main focus of the culture and tourism development strategy of the future. Information technologies in space facilitate the instant integration of tourists into the tourist environment and allow them to plan their own trip, communicate with local residents of the territory through a headset with simultaneous translation, receive personalized recommendations for visiting museums, places for recreation and entertainment, taking into account their preferences, etc. These additional values for the consumer from the use of information technology in the process of obtaining a tourist product need to be mastered by domestic market operators in the process of developing a post-war business strategy.

In general, the information space in tourism performs certain functions (Fig. 1).
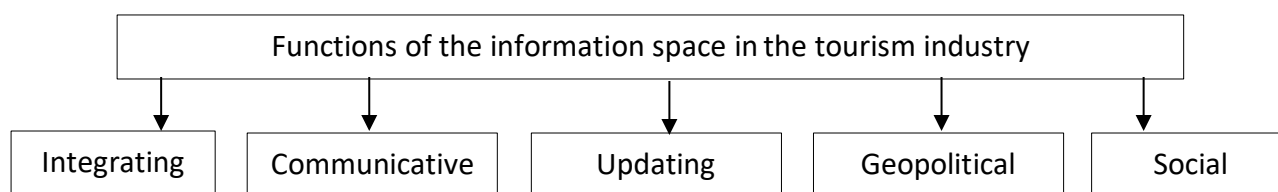

Functions of the information space in the tourism industry				
Integrating	Communicative	Updating	Geopolitical	Social

Figure 1. Functions of the information space in the tourism industry

Integrating – combining digital space and various types of human activity, including both individuals and entire states, nations and international coalitions, transnational corporations into a single spatial, communicative and socio-cultural tourist environment.

Communicative – the implementation of digital exchange within the created special environment through cross-border, interactive and mobile communication of various tourism actors.

Updating – the subjects of tourism activity in the form of their information policy implementation actualize their interests.

Geopolitical – the development of resources changes the importance of traditional ones, creates a new environment of geopolitical relations and competition in tourism.

Social – the transformation of the composition of society, changing the nature and content of social relations in all areas of the tourism industry.

When developing the domestic tourism industry in the post-war period, it is necessary to take into account the main directions of formation of the information society in the world, which include: free access to various tourist information; development of the human potential of the information society; creation of electronic programs of tourism infrastructure; development of cultural diversity, identity and linguistic diversity; development of specialized electronic media of tourist orientation.

Modern information tourism should be understood as a concept based on the constant and systematic use of information technologies in creating additional value of tourist experience for users. The introduction of information technologies in the post-war recovery of the tourism industry should not only simplify and speed up certain tourism processes and procedures, but also increase the competitiveness of the industry, ensure its sustainable development and integration into the post-war life of society and the economy.

The main information technologies in the tourism industry are as follows:
– Big Data. Technology content: analysis of a large amount of data generated from various sources (networks, websites, etc.). Beneficial effect of implementation: optimization of the development of tourism products and marketing strategies for

their promotion (gaining insight into consumer preferences and behavior, improving and personalizing customer experience, improving pricing and maximizing profits);

– Internet of Things (IoT). Technology content: creation of an interconnected network of devices and sensors that collect and exchange data in real time. Beneficial effect of implementation: improved navigation, management of the flow of visitors and waiting time, monitoring of weather conditions, hazards, pollution, etc;

– artificial intelligence (AI). Technology: creation of chatbots, virtual assistants, and other computer systems to help with travel planning, improve travel operations, and enhance customer service. Beneficial effect of implementation: provision of personalized recommendations, automation of routine tasks related to ticketing, booking and customer service, demand forecasting and improvement of the overall customer experience;

– virtual and augmented reality (VR/AR). Technology content: providing an exciting and interesting interactive experience for tourists and the opportunity to immerse themselves in a virtual environment. Beneficial effect of implementation: creation of VR/AR tours, interactive guides and guides, extreme types of recreation without repetition in real life, improvement of exhibits in museums and immersive advertising campaigns;

– blockchain. Technology content: ensuring the security of travel payment transactions, reducing fraud risks, supporting sustainable tourism. Beneficial effect of implementation: transaction management, secure storage and tracking of booking information, ticket sales, tourist identity verification, etc;

– mobile applications. Technology content: quick search for information, access to maps, booking accommodation, receiving other tourist services. Beneficial effect of the implementation: additional value of the tourist product for the consumer in the form of a wide information space.

The role and use of information technologies in post-war developments and plans for the development of the tourism industry should contribute to the solution of the following tasks:

– adequate assessment of the state of the tourism sector and the main problems of development;

– determining the priority areas of tourism industry development that best meet the interests of investors, businesses, and the population;

– improving the image and increasing the attractiveness of the tourist area;

– stimulating the socio-economic development of a particular domestic territory based on the development of its tourism infrastructure;

– providing tourists with detailed and up-to-date information on a wide range of tourist topics, routes, attractions, locations, etc;

– providing micro- and small tourism organizations with the opportunity to promote their services, facilities and other offers to the market inexpensively and effectively;

– providing a cost-effective way for any domestic organization to distribute tourism information through digital networks;

– providing an alternative marketing system and information channels;

– creating an open information system for selling tourism services.

Information technologies for the post-war recovery of the tourism industry should include an integration framework, as shown in Figure 2.
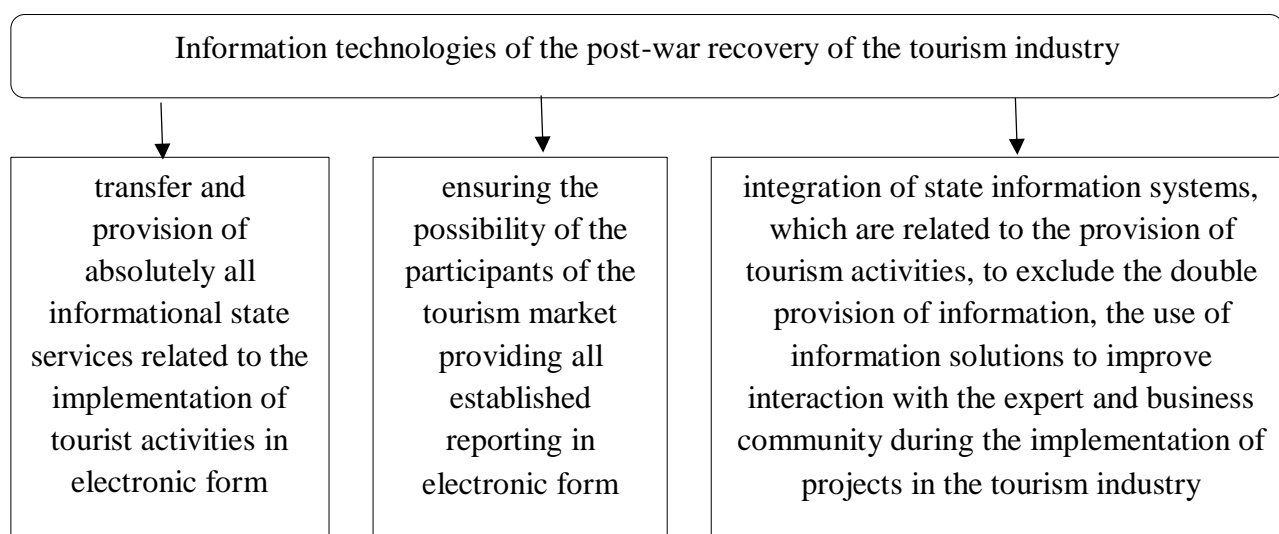
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┌──────────────────────────────────────────────────────────────────────┐
│ Information technologies of the post-war recovery of the tourism industry │
└──────────────────────────────────────────────────────────────────────┘

┌─────────────────┐  ┌─────────────────┐  ┌──────────────────────────────────┐
│ transfer and    │  │ ensuring the    │  │ integration of state information │
│ provision of    │  │ possibility of  │  │ systems, which are related to    │
│ absolutely all  │  │ the participants│  │ the provision of tourism         │
│ informational   │  │ of the tourism  │  │ activities, to exclude the       │
│ state services  │  │ market          │  │ double provision of information, │
│ related to the  │  │ providing all   │  │ the use of information solutions │
│ implementation  │  │ established     │  │ to improve interaction with the  │
│ of tourist      │  │ reporting in    │  │ expert and business community    │
│ activities in   │  │ electronic form │  │ during the implementation of     │
│ electronic form │  │                 │  │ projects in the tourism industry │
└─────────────────┘  └─────────────────┘  └──────────────────────────────────┘
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Figure 2. Information technologies of the post-war recovery of the domestic tourism industry

One of the important tasks for the rapid post-war recovery and development of domestic and inbound tourism is to create conditions for the formation of a tourism ecosystem, which should unite all market participants on an online platform for the formation of a better customer experience, integrated with external data sources and social platforms. On the basis of the platform, various blocks, services, mobile programs can be developed, which will implement functions related to the promotion of the tourism product of Ukraine [7; 8; 15].

The «most important» information solutions should include the following:

– creation of a tourist marketplace and centralization of efforts to promote Ukraine's integrated tourism product;

– introduction and development of multilingual tourist assistance services, including information services, navigation and self-service services, in order to increase the availability, quality and attractiveness of tourist services, and increase the efficiency of using tourist information resources;

– development and implementation of a guest information tourist map and a similar mobile application in different locations and territories of Ukraine (analogous to international maps and applications for mobile devices that allow tourists to travel by various means of transport, learn about cultural activities and events, and enjoy discounts when visiting tourist destinations);

– providing a transparent information system for assessing the quality of tourist services, creating a rating of services and facilities in the tourist areas of Ukraine;

– providing an opportunity to get acquainted with cultural and natural monuments, museum exhibitions, tourist routes online using visualization technologies, virtual tours, etc.;

– creation and development of augmented reality services for navigating cities and objects of display and demonstration (exhibition centers, art galleries, museums, etc.) to increase the attractiveness of tourist attractions and the efficiency of using domestic tourism resources;

– development of an open data system to increase the transparency of organizations and the management system of the tourism industry, create favorable conditions and infrastructure for the development of new types of tourism services;

– introduction and development of artificial intelligence and big data technologies for their collection and analysis, development of a system for promoting tourism services, formation of the most relevant offers for travelers, taking into account their wishes, weather conditions, traffic situation, etc.;

– development of information services for online tourist route planning with the possibility of buying tickets and booking hotels;

– creation of an electronic platform for engaging self-employed persons in tourism activities (guides, instructors, tour guides, other figures);

– development of multimedia programs for the objects of display, audio and video guide services with the possibility of their integration with GPS navigation, using QR codes to generate requests.

Areas of information technology implementation in the tourism space should include: 1) online services with personalized recommendations based on big data; 2) wearable gadgets for simultaneous translation; 3) sharing services; 4) smart navigation system adapted to foreign languages; 5) free high-speed Internet in public places; 6) use of multimedia technologies and guide applications in museums.

It makes sense to separately highlight Internet technologies, which should be understood as Internet technologies that facilitate the creation and further existence of various information resources, as well as applications used for interaction between participants in various activities. Currently, travel agencies use Internet technologies for two main purposes: marketing and direct sales of services. Internet technologies such as websites, online booking, online purchase of a travel product, and tracking customer preferences are actively used. It is interesting to categorize travel companies into levels depending on the Internet technologies they use.

First level. A company's website can be of two types: a business card site with a simple list of services and an interactive site designed to collect feedback and suggestions and contact the client. There are certain criteria for creating websites: the information you need should be found quickly, the user should be able to easily navigate and understand what information he or she has already seen, and it should be possible to search for and select information on the topic of interest to the client. A small business site is an additional advertising tool for a travel agency because it provides information about the company.

The second level. A business card site, which almost every existing company has nowadays, no matter how small its business is, given the fact that the client receives the main information about the company from the Internet. A travel agency on such a site posts its news about «hot tours», its partners, and the main areas of work. A price list is very rare for a travel agency, since almost every tour is calculated individually for the client's needs. The disadvantage of a business card site is the lack of opportunity to hear the consumer's opinion. An interactive website can provide more information to both the consumer and the company. It is a means of communication between a travel agency and a tourist, providing an opportunity to ask a question online and get an immediate answer instead of calling and wasting some of your time. Such a site also provides an opportunity to write a review. A review about the company and the trip tells a new client about the reputation of the travel agency, and travel agents about the client's preferences and possible directions for the company's development. The disadvantage of such a site is that the travel agent has no direct influence on the sale of the travel product. Online booking and online purchase of a travel product are simultaneously included in the third and fourth levels of this system.

Third level. An online store is a full-fledged mechanism for selling a travel product (for travel agencies) that allows you to place orders, make reservations, conclude contracts, and purchase tours through cashless payments. Almost all websites are platforms for comparing offers from different hotels, booking rooms and making subsequent purchases. The websites of large tour operators always offer the purchase of a complete tour, including airfare, transfer (transfer) from the airport to the hotel and back, and, directly, accommodation with meals. The same category of Internet technologies includes airline websites that offer booking and purchase of airline tickets. Moreover, such sites often offer the use of an electronic ticket instead of a regular paper ticket, as well as the choice of a seat in the cabin, i.e. online check-in. Another feature of websites that allow booking and purchasing a travel product is online tracking of user preferences and statistics. This option is present on almost every website and app, which allows you to promote your services and allows you to choose a marketing strategy based on the research data.

The fourth level of Internet technologies that are actively used in the travel business includes business systems. By business systems we mean platforms that are able to integrate the offers of many tour operators simultaneously. Business systems are described as mechanisms that combine all three previous levels. For a subscription fee, business systems ensure the security of doing business for the company, confidence in the security of the company for the client, and the security of all transactions for both parties. The disadvantage of business systems is high competition, as the client can directly compare travel products by such criteria as price and quality (an indicator is reviews). However, there are business systems that fully automate the contact between the tour operator and the tourist,

Having a wide range of different Internet technologies in its arsenal after the war, the tourism business still needs further improvements and other innovations that

can further simplify the process of creating and promoting a tourism product. There are several areas of innovation in the field of Internet technologies for travel agencies that have prospects: 1) advertising, informing the client, forming a positive image; 2) uniting all participants in the tourism product value chain, such as tour operators, insurers, carriers, hotels, and others; 3) business organization, for example, using databases and statistics based on a website. In general, despite expectations of a rapid post-war recovery in the tourism industry and the development of the online travel sales market, large tour operators in Ukraine should not be afraid of the majority of tourists switching to independent online bookings, as the price will remain the determining factor when buying a tour. The second place goes to value for money. That is, those tourists who have been traveling for several years will value quality. A tour operator with its own charter chains, own hotels, guaranteed blocks of rooms in the largest hotels will also offer tourists unique low prices that will ensure its competitiveness. Another important factor for tourists will be the ability to stay in touch with the tour operator and get help and support in case of problems.

Tourism organizations provide mainly information services, and the entire industry is information-saturated. Therefore, the use of innovative technologies in the post-war period of recovery of the domestic tourism industry is an essential condition for increasing the competitiveness of any tourism organization. Along with the common needs of the tourism industry in the use of information technology for the production and sale of tourism products, each type of tourism requires specific information support. However, despite the diversity of demand for information services, it is advisable to create unified integrated information structures in which the same universal tools are used to transmit, process and display different information for the benefit of different users.

At the same time, there is no unified policy and unified standards for building information support in the tourism industry today, although the modern global informatization of tourism is actually becoming a process of its integration, with information unification of tourism personnel and clients. In tourism, after the victory over Russia, tourist information centers will be effective.

The main drawback of the creation and operation of tourist information centers is the lack of systematic and constructive approach to the problem of studying the structure and features of the modern tourist information space. The main objectives of creating tourist information centers are: 1) assisting regional administrations in developing and implementing an information strategy for promoting regions to the international and domestic markets of tourist services; 2) increasing the information accessibility of regions, territories, locations; 3) creating investment attractiveness of the tourist and recreational sphere; 4) attracting extra-budgetary funds for the development of the tourism industry of a particular region; 5) forming a modern system of information technologies that ensures effective interaction of various tourism entities. The main expected result of the implementation of the strategy for the post-war development of the system of tourist information centers in Ukraine is the creation of conditions for meeting the needs of domestic and foreign tourists for

information on tourist services, social and intensification of domestic and inbound tourism.

In recent years, the global tourism industry has been shaped by factors driven by the development of information technology. This requires domestic tourism market participants to understand and take into account new post-war trends and trends that will transform the business by changing approaches and methods of communication, partnership, information and data exchange. Information technologies have radically changed the way of life, leisure, recreation, mobility and tourism in all its forms. For the post-war recovery and development of tourism in Ukraine, it is necessary to develop tourism products for their implementation in the new information environment, which should reveal the potential and capabilities of domestic tourist destinations and locations. Currently, in the post-war period, there will be a need to change the approach of the state to facilitate the rapid introduction of innovative digital technologies by micro, small, and medium-sized businesses in the tourism industry. Further research in this area will be relevant and timely.

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18. MINIMIZATION OF INFORMATION SECUTIRY RISKS AMID THE CHALLENGES OF DIGITAL SOCIETY

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The object of research is the process of minimizing information security risks in the face of challenges of digital society. The subject of the study is information security and the search for tools to ensure it in the face of challenges of digital society. The aim of our research is to reveal the theoretical and practical aspects of minimizing information security risks in the context of the digital environment challenges. The research subject is minimization of information security risks caused by the digital environment challenges. The research task is to analyze the model of minimizing information security risks in the context of the digital environment challenges, identify the issues arising in this process and make suggestions with

regard to minimizing information security risks amid the challenges posed by digital society. It is established that now businesses should cooperate and find time in order to adapt to the new conditions and formulate the policies which will enable them to face the future. It is noted that businesses should adopt those policies, update certain technologies, and strengthen multi-level network security. It is substantiated that in the following cases when examining the risk landscape, it is important for IT managers to consider not only the most likely scenarios, but also those, which are potentially disastrous. It is proved that moreover, IT managers should have risk management strategies and physical networks, which are enough reliable to withstand unexpected events, whether it is a rapid increase in the number of remote workers or a new type of malware, and consequently, this is the IT managers' responsibility to build the networks capable of dealing with such unexpected events.

The article is concerned with the phenomenon of minimizing information security risks caused by digital society challenges. Since the major function of an IT-company is to provide employees with possibilities to perform their tasks and maintain smooth operation of their business, network security has acquired utmost relevance. It is established that in order to understand what threatens network security, employees must have a thorough knowledge of effective data protection methods, which includes providing them with additional training in security measures so that to prevent risks to the company due to various threats posed. The model of minimizing information security risks in the context of digital environment challenges is analyzed and the issues arising in this process are identified. The essence and areas of minimizing information security risks in the digital environment are revealed. The conditions and ways of overcoming information security risks caused by the digital environment challenges are clarified. It is proved that the goal of information security is to protect a company from attacks launched on its information assets. It is justified that privacy protection involves safeguarding people from attacks related to their personal data.

Introduction. Minimization of information security risks (ISRs) in the context of the challenges posed by digital society is an extremely relevant topic for any company or organization. Companies are constantly generating large amounts of data, IT systems are becoming more complex, and cyber threats are constantly evolving. The challenges that organizations face may sometimes seem endless, and the budget and resources may appear too limited to overcome those challenges. Government agencies have also become victims of cybercriminals, especially through ransomware. Without stern network security measures, these public sector actors can be a major target due to the lack of reliable protection.

However, IT managers and their teams are able to protect their own data and confidential communications when faced with aggressive cyberattacks and an increased number of remote employees. The disruptions that accompanied the COVID-19 crisis took managers by surprise, leaving little time for planning and preparation.

Poor computer practices in businesses and organizations highlight data vulnerabilities, namely file-sharing on free platforms, professional data backup on PCs, personal access identifications records for automatic reconnection, which may result from ignorance, negligence, or a search for personal convenience. Trainings for users and awareness-raising activities will help ensure that data security measures are strictly applied. Preventive measures should be aimed at reducing risks of incidents, loss or unavailability of data. Computer security tools and protocols will protect a company's network and computers against possible external or internal attacks. These tools and protocols should include both user access control and restrictions on user privileges: changing passwords or restoring a session when an employee is dismissed from the company, etc. The functions of utmost importance are performed by security detection and monitoring tools: antivirus software, server control and monitoring, intrusion detection systems (IDS), regular updates to computer security software and tools, and data backup policy that will help to recover in case of an accident. Information security in digital environments should be determined by several criteria: 1) data identification: volumes, important data; 2) storage media: hard drives, servers, online backups; 3) backup method: full, incremental or differential backup; 4) backup frequency: real-time backup or scheduled backup. All these should help minimize risks at an enterprise or in an organization. Therefore, identifying information security problems is of great theoretical and practical importance.

Since risks are unavoidable, understanding and managing the risks to systems and data are critical to a company's successful performance. Developing an ISR program simplifies risk management and helps protect critical assets from new cyber threats. Having capabilities to manage risks and effectively respond to security incidents, managers will be able to better counter cyber threats and reduce potential risks in the future. According to the IBM Security-funded Cost of a Data Breach Report 2019, the average cost of corporate data leaks worldwide was USD 3.9 million [1]. The average cost of one hacked record was USD 150. The healthcare industry suffered the greatest losses from cybercrime: the average cost of one data leak was USD 6.4 million, with the average cost of one case making up USD 429. It is important to note that lost business cost was the most important factor in calculating the total cost of data leakage. It was small and medium-sized enterprises (SMEs) that were exposed to the greatest risks as a result of security breaches. Attacks targeting small and medium-sized businesses are more costly than those launched on large businesses. Moreover, cyberattacks can be fatal for small or medium-sized businesses, e.g., in 2016, the National Cybersecurity Alliance of the United States found that 60% of small businesses closed down six months after the cyberattacks.

The Cost of a Data Breach Report 2019 says that 60% of cyberattacks can be attributed to inappropriate human behavior [1]. Due to the deployment of new digital tools to speed up communication and data exchange, projects may be completed in haste, with some users having not mastered their new working tools in full. In the context of data security, human error can be associated with "abuse" of collaboration

tools. These errors cause security incidents faced by companies, which cannot be ignored. The main directions for correcting human errors, which affect data security, are as follows: 1) improvement of visibility for users to control data hazards; 2) review of access rights to improve visibility, detect and correct human errors; 3) maintaining of user autonomy as a security risk factor. According to the CESIN survey, 80% of CISOs responded that management of sharing by employees was the major hazard to the company's data [2]. The analysis showed that several years ago, the user depended on IT for data sharing. It was only possible through file servers created and controlled by IT departments. Now we are observing a paradigm shift, as the user has started to administer his actions. He disposes of numerous tools to make creating spaces for sharing and data transfer easier. Currently, the user has a great influence on their data. Configuration errors or negligence of administrators or employees accounted for 33% of security incidents experienced by companies in 2021 [2]. The consequences of these actions can be serious and lead to increased risks: data leakage, loss of trust, bad reputation, and non-availability of services.

Each organization or enterprise must have a business continuity plan and a business recovery plan, which are meant to ensure that the company's operations and/or IT processes are maintained and then restored. In case the measures defined during the development depend on the specifics of the company, it is necessary to make the following steps: 1) to develop crisis scenarios and conceive their impact on the company; 2) to identify critical business assets and data; 3) to determine the roles in the team responsible for applying a business continuity plan and a business recovery plan; 4) to update the plans in accordance with the development of the company's infrastructure. Since computer data is stored for a very long time, even if it is mistakenly considered to be destroyed or lost, in most cases it can be recovered. Data recovery should be entrusted to a qualified specialist who can make an accurate diagnosis and apply appropriate tools [3].

Suggestions. It is of importance that the structural components of Continuity Plan and Recovery Plan should be identified.

1. Centralized Security Management. Centralized management enables IT teams to centrally monitor, manage, and configure thousands of devices regardless of the place the end users work at – a field office or a kitchen table. With Digi Remote Manager, IT managers can grant or deny access to a network at the individual employee level. Implementing the security protocol and updating firmware are easier and safer with Digi Remote Manager. Connecting to remote locations can be a major challenge for people living in remote suburbs or rural areas, or even in tall buildings. Power over Ethernet (POE) on Digi LTE secure extenders allows remote workers to isolate the best signal reception in their working environment, and then run a single secure cable to their home office. Preparing for the next crisis: business leaders and IT managers should be prepared for any scenario, including a long period of time or return of employees working outside the enterprise and need a remote connection to the corporate network. The world has changed, so has the labour force. The number of people working remotely, i.e. from home, has never been so huge. This enormous

upward trend puts pressure on corporate IT departments as they are striving to provide remote workers with reliable connection while managing network risks. Due to this trend and the lessons learned from the COVID-19 pandemic, cellular connectivity with enterprise security is one of the best long-term investments, which a business can make. Digi solutions can help reduce the burden carried by IT staff and facilitate the security aspect of IT work, freeing the staff from focusing on more business-oriented issues.

2. Multi-factor Authentication. Passwords are the first line of protection for most networks. However, the research shows that almost 60% of employees use the same password for multiple accounts. Multi-factor authentication solves this problem by requiring end users to provide not only a standard username and password, but also additional factors [4].

3. Virtual Private Networks (VPNs): VPN tunnels with multiple options, such as IPsec and OpenVPN, are the standard secure connection option for most organizations. But a VPN alone does not provide the same security level as that of internal corporate networks. Generally, a PC-based VPN only allows remote access to centralized resources, while local internet browsing still uses local connection. This is a risky scenario for home-based workers. Encrypted VPN tunnels that run between remote work environments and the corporate network via Digi routers or extenders are more secure and can be configured and managed remotely using Digi Remote Manager Software.

4. Encryption is one of the most effective methods to prevent security breaches. Encryption can be used to protect confidential messages by protecting data when it is transmitted over the network. It also protects information stored on your computer in the event of theft or hacking.

5. Content Filtering and Blocking: consumer-level connections usually do not have proper content filtering and blocking capabilities, which is a key factor for working from home, where family members and visitors can have access to an employee's PC, where even a hobby website can be a means of transporting malware. Advanced solutions allow enterprise IT departments to add content to the blacklist and whitelist with source-based routing, so only approved sites can be accessed, which provides an additional benefit for homes with children.

6. Enterprise DNS Filtering: services such as Cisco Umbrella provide domain name system (DNS) filtering, which combines multiple cloud security services to block access to malicious website domains even before the connection is established. DNS filtering services are built directly into Digi devices.

7. Business-class Routers: home Wi-Fi routers with consumer features are not secure enough to protect business assets. With Digi enterprise cellular routers and extenders, such as Digi EX15, an enterprise's IT staff can extend and apply mission-critical security policies within a corporate network.

Thus, disaster planning and network security risk management can facilitate faster fact-based decision-making in stressful environments. Security policies should also be reviewed and updated regularly to keep up with new threats. It was found that

organizations with Incident Response Teams were able to faster respond to data breaches, when they occurred, in order to limit the damage.

Information security risk management (ISRM) is the process of managing risks associated with use of information technology. In other words, organizations identify and assess risks to the privacy, integrity, and availability of their information resources. This process can be divided into the following major components: risk assessment and risk handling [5]. Risk assessment is the process of combining the information you have collected about assets, on the one hand, and controls, on the other, in order to identify risks. Risk handling involves actions taken to correct, mitigate, avoid, accept, transfer, or manage risks. There are various frameworks that can help organizations develop an ISRM strategy, but you should consider the organization's risk profile with a detailed description of each risk and the level of risk this organization is willing to take to achieve its goals. The ISRM concept includes the following actions:

1. Protection – organizations implement appropriate security measures and controls to protect their most important assets from cyber threats. This can include, for instance, identity management and access control, awareness-raising, and staff training.

2. Detection – organizations need to quickly identify events that may pose threats to data security. Typically, organizations rely on continuous security monitoring and incident detection methods.

3. Response – organizations take actions on the detected cybersecurity incident. They can use the following methods to restrict the impact of an incident: response planning, communication, analysis, mitigation, and improvement.

4. Recovery – organizations develop and implement actions to restore opportunities or services affected by a security incident. This group of measures promotes rapid recovery of normal operations in order to reduce the impact of incidents; this includes recovery planning, improvements (e.g. introducing new policies or updating the existing policies), and communication.

5. Information Security Risk Management (ISRM) is an ongoing process of identifying, evaluating, and responding to security risks. To effectively manage risks, organizations should assess the probability of events that pose risks to the IT environment, as well as the potential impact of each risk. Here are three criteria that help determine whether an ISRM strategy effectively improves your security: 1) it allows you to identify unacceptable risks and deal with them in an appropriate way; 2) the strategy allows you to avoid spending money and effort on minor risks; 3) it provides management with a vision of the organization's risk profile and risk management priorities thus facilitating strategic decision-making.

6. Planning, which is currently is being done by organizations to mitigate the threat of cyberattacks, helps them prepare for further events that may force these organizations to switch to remote work, including natural disasters, such as floods, fires, or hurricanes. In particular, the possibility of extreme weather events increases the value of remote work. After failures, this is automatic switching that is used to protect the continuity of network communications. This means that if one connection

fails, the backup connection automatically switches to operation until the main connection is restored.

7. Implementation of network security plans. The National Institute of Standards and Technology (NIST) website and other security experts have provided a number of specific recommendations for ensuring the safety of remote workers. Physical security: the risk of loss or theft increases significantly when people work remotely. Employees should be reminded to be very careful and not to leave their laptops unattended, even at home. Users should carefully choose strong passwords and store them separately from their devices.

8. Data Backup and Recovery. Organizations with a large number of confidential archives to manage should install a data backup and recovery system. Careful backups can save months or even years of work for a company. Therefore, it is essential that staff members should be properly informed of the current protective procedures and role they are called upon to play in the relevant procedure.

Thus, employees should be informed about security issues, since employee awareness is crucial when it comes to effective data protection practices. To strengthen data security training policies, some companies choose to create an awareness team whose primary function is to create, implement, and monitor the company's data security awareness program. This program varies depending on the organization and its needs.

Additional training may be carried out depending on the role and responsibilities of each employee. The main goal is to ensure appropriate training for employees who need it. By communicating these advanced data security techniques to their employees, organizations can help protect their systems both internally and externally [6].

1. Advanced authentication methods. A password is a storage access key that contains company data, which should be considered as super confidential information. In this context, password managers can improve the use of corporate passwords by optimizing the login process for employees who have to remember several complex passwords. Using a password manager only allows saving one password: the software will take care of everything else. We recommend using a two-factor authentication process for sharing files and emailing. This is a security procedure, in which the user must perform two checks from two different types of credentials. This provides better security, as systems remain secure even if certain company passwords are cracked.

2. Data Encryption. Most organizations advocate extreme precautions, when it comes to tracking the location of a company's computers and mobile phones. However, even if employees are particularly conscientious, theft remains a real threat. This is why data encryption is at the forefront of best data protection practices.

3. Improvement of data visibility and management for users. Improving visibility for users is the first step towards avoiding basic types of human errors. The co-author should be able to see the permissions, delegations and rights set for their shared data. Nowadays certain information is either transmitted to the user bit by bit, or distributed among each SharePoint, OneDrive, or Teams application. The example

of OneDrive is illustrative: the user must enter the cloud application, open each file to find out who has access to them, and manage it.

4. Human errors: monitoring the risks of sharing. One possible lever is to conduct a rights review campaign involving an employee. Consequently, setting up regular rights checks allows starting the process of rechecking access and sharing content.

Thus, we made an attempt to identify the essence and directions of minimizing information security risks amid the digital environment challenges.

Practice shows that a step-by-step approach to creating an information security risk management program (ISRM) is the most effective because it forms a more comprehensive program and simplifies the entire process of information security risk management, breaking it into several stages. This facilitates the management of the ISRM process and helps eliminate problems. To determine if your ISRM program has all the necessary features and capabilities, it is important to use several compliance standards and structures [9].

1.You should use key performance indicators (KPIs) to measure the effectiveness of features and capabilities developed with ISRM. When developing KPIs, you need to identify the business value that you plan to achieve with ISRM capabilities, and then identify objective criteria that can be used to evaluate those values. Attempt to base key performance indicators (KPIs) on potential economic impact and targeting guidelines. This will help establish a link between security and the economic context in which the organization is held. In addition, it is important to define thresholds, the network security policy should define organizational rules for the proper use of the company's computing resources. The policy should form strong password protocols, restrict access to and use of the website, as well as proper use of email, fight phishing, fraud, ransomware. To combat this, organizations must take measures - prevention, protection, detection, response, and plan to reduce these risks to an acceptable level. Further Data Protection Impact Assessment (DPIA), which is a privacy impact assessment tool.   Data protection is based on 2 pillars: 1) fundamental, "non-negotiable" principles; 2) rights established by law to combat phishing, fraud, ransomware. Risk management allows you to identify appropriate technical and organizational measures to protect personal data.

There are three main types of human error that affect data security and its implications for information security, allowing you to manage and cover risk.

1. Attention deficit. Whether it's clicking a hacked link, visiting an unsecured site, or even installing malware, the negligence comes from lack of time on the part of the employee or ignorance of cybertraps. Employees lack time and commitment. They have a lot of information to work with during their working day, and safety rules are not their priority. Employees sometimes feel indifferent. Cybersecurity is a rather abstract topic that is often perceived as restrictive. In addition, it is also often associated with a lack of awareness of risk. There is indeed a gap between the action taken and the consequences it can have, for example, if it is rejected. However, awareness is important to mobilize and empower the worker.

2. Setup error. The work environment and all available Workplace tools can become challenging for an employee. For example, the Microsoft package is filled with features, applications that are interconnected: personal OneDrive, shared teams, or shared SharePoint storage. Each application will have its own characteristics and settings, and the implementation is not always transparent to the user. This can have a direct impact on mastering tools. The user can, for example, share a link that is too allowed, anonymous, and make the document available to all employees and even to outside people. Also, the default share link in Outlook is anonymous. This type of error may cause risks of data leakage, integrity, or inconsistencies.

3. Rights management over time. The third type of error is more subtle and concerns the consequences of the lack of access monitoring, exchange over time. The difficulty teams face in this context of collaboration is data lifecycle management. Information is in perpetual motion. The user does not always remember to whom he shared the data, does not always see who can access his data. For example, by accidentally collaborating, a user will grant rights to their storage space or grant external access.

These three types of human error directly affect data security, the importance of controlling usage and holding users accountable, which requires improved visibility to control data security risks.

Conclusions. Network and data security is a risk for the entire enterprise. The IT security professional must be responsible for data protection and have centralized responsibility for data management. He must manage and coordinate the company's response (general counsel, risk management, public relations/marketing, general management) to a cyberattack. This person must be a member of the incident response team. Finally, it is necessary to follow all ISRM steps (identify, protect, detect, respond, and recover) and repeat them regularly. It is imperative that organizations formulate policies that describe all phases of ISRM, employee responsibilities, and program review schedules, or conditions. Major changes in the IT environment, industry data leaks, or new cyberattacks are all reasons to critically analyze the ISRM program and review it if necessary. Companies are increasingly dependent on technology, in a world that has become digital, there are new risks that require new methods of protection.

Data loss is a daily threat to all companies, which occurs due to intruders. Many data breaches occur as a result of internal errors by employees or due to a lack of understanding of data security best practices. To eliminate any threat in this area, companies must implement internal security procedures and train employees to be aware of all potential threats to the company's IT security. First, it is important to remember that managing data security and data risk depends on software technology, hardware, human processes, and behavior. Second, the risk to data depends heavily on security. To reduce data risk, it's important to have the right tools in place to ensure high data quality. Effective data management is essential to use it effectively.

We believe that it is appropriate to determine measures proportional to the risks that will be affectedby:

1) "elements subject to protection": data minimization, encryption, anonymization, granting rights, etc.;

2) "potential consequences": data backup, activity tracking, data leak management, etc.;

3) "sources of risk": access control, management of third parties, fight against malicious code, etc.;

4) "media": reduce the vulnerability of hardware, software, networks, paper documents, etc.

To minimize risks and reduce them to an acceptable level, risky uses should be identified: unsafe exchange, access to messaging, strategic account configuration error. The challenge is to be able to take corrective action in a timely manner, reduce vulnerabilities, and prevent any risk of data leakage. Now there are advanced monitoring and detection systems, but without user intervention in this device, the scheme is incomplete to protect data, so teamwork is needed that can bring results.

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19. OBJECTS RECOGNITION AND CLASSIFICATION USING TRANSFORM AND SKELETONIZATION METHODS UNDER DIFFERENT LIGHTING CONDITIONS FOR SMART CITIES

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Object recognition and classification are crucial tasks in the field of computer vision with numerous practical applications. However, achieving accurate and robust results under varying lighting conditions remains a challenging problem. This paper presents a novel approach that combines transform and skeletonization methods for effective object recognition and classification in diverse lighting environments. The proposed method employs a multi-scale transform to extract meaningful features from object images. The transform captures both global and local characteristics of objects, allowing for robust representation despite lighting variations. Additionally, skeletonization is employed to extract the structural skeleton of objects, which provides a concise and invariant representation. To handle different lighting conditions, the proposed method integrates illumination normalization techniques into the recognition pipeline. These techniques enhance the visibility of objects by compensating for lighting variations, thus improving the overall recognition accuracy. Experimental results demonstrate the effectiveness and versatility of the proposed approach. The method achieves superior performance compared to existing methods under various lighting conditions, including low-light, high-contrast, and unevenly illuminated scenarios. Furthermore, the proposed method exhibits resilience to occlusion, noise, and cluttered backgrounds.

1. Introduction

The concept of a smart city involves the integration of various technologies (including automated data collection systems). The authors investigate the possibility of using computer vision to solve the problem of automated data entry. In particular, the mechanism of skeletonization in automatic authentication is investigated. This is part of the problem of accessing spaces with special permissions. In recent years, object recognition and classification have gained significant attention in the field of computer vision due to their widespread applications in various domains such as autonomous driving, surveillance systems, and robotics. The ability to accurately identify and categorize objects in images or videos is crucial for enabling intelligent decision-making and understanding the visual environment. However, achieving

reliable recognition and classification performance under different lighting conditions remains a persistent challenge.

Lighting variations pose a significant obstacle to object recognition systems, as they can dramatically affect the appearance and quality of object images. Illumination changes can result from factors such as varying natural lighting conditions, artificial lighting sources, shadows, and reflections. These variations can cause significant degradation in the visual information captured by imaging devices, making it difficult to differentiate and classify objects accurately.

To address the issue of lighting variations (including low light [1]), this paper proposes a novel approach that combines transform and skeletonization methods for object recognition and classification. The primary goal is to develop a robust system that can handle different lighting conditions effectively. The proposed approach leverages the advantages of both transform-based techniques and skeletonization methods to extract discriminative features and structural information from object images.

Transform-based methods have shown promise in capturing various visual patterns and characteristics of objects. By analyzing the frequency or spatial domain representations of objects, these methods can extract meaningful features that are robust to lighting variations. On the other hand, skeletonization techniques provide a concise and invariant representation of object structures, enabling efficient matching and classification.

To further enhance the performance under different lighting conditions, illumination normalization techniques are integrated into the recognition pipeline. These techniques aim to normalize the illumination levels in object images, thereby reducing the impact of lighting variations and improving the overall recognition accuracy.

The contributions of this research lie in the development of an integrated framework that combines transform, skeletonization, and illumination normalization methods for robust object recognition and classification. The proposed approach aims to address the limitations of existing methods and provide reliable performance under diverse lighting conditions, including low-light, high-contrast, and unevenly illuminated scenarios.

The effectiveness of the proposed approach will be evaluated and compared against state-of-the-art methods using benchmark datasets. The evaluation will encompass various lighting conditions and consider metrics such as recognition accuracy, robustness to occlusion, noise, and cluttered backgrounds. The results of the experiments will provide insights into the performance and potential applications of the proposed approach.

This paper aims to contribute to the advancement of object recognition and classification techniques under different lighting conditions. By leveraging transform, skeletonization, and illumination normalization methods, the proposed approach offers a comprehensive solution to address the challenges posed by lighting variations.

2. Materials and methods

2.1. Overview of object recognition and classification

Object recognition and classification have been extensively studied in the field of computer vision, with numerous approaches proposed to tackle this challenging task. Various techniques have been explored to extract discriminative features from object images and enable accurate classification.

Traditional approaches often rely on handcrafted features, such as Scale-Invariant Feature Transform (SIFT) [2], Histogram of Oriented Gradients (HOG) [3], and Local Binary Patterns (LBP) [4]. These methods extract local descriptors that capture distinctive information about object appearance and shape. However, they may struggle to handle variations in lighting conditions, viewpoint changes, and occlusion.

With the advent of deep learning, Convolutional Neural Networks (CNNs) [5] [6] have revolutionized object recognition. CNN-based architectures, such as AlexNet [7] [8], VGGNet [8] [9], and ResNet [10] [11], have achieved remarkable performance by learning hierarchical representations from large-scale labeled datasets. Transfer learning, where pre-trained CNN models are fine-tuned on specific recognition tasks, has also become prevalent.

Furthermore, advanced techniques have emerged to address specific challenges in object recognition. For instance, attention mechanisms focus on relevant image regions, aiding in handling cluttered backgrounds. Spatial pyramid pooling aggregates features at multiple scales to capture object context. Additionally, ensemble methods, such as bagging and boosting, combine multiple classifiers to improve classification accuracy.

Recent research has also explored the integration of object detection and recognition, where object bounding boxes are predicted along with their corresponding labels, parallel approaches for thinning [12] [13], topological graph analysis [14].

2.2. Skeletonization methods

Skeletonization methods have been extensively explored in the field of image processing and computer vision for extracting the structural representation of objects. Skeletonization aims to capture the essential shape and connectivity information of objects while discarding unnecessary details.

One commonly used skeletonization technique is the thinning algorithm, which iteratively erodes the object boundaries until a one-pixel-wide skeleton is obtained. Thinning algorithms, such as Zhang-Suen [15] [16], Guo-Hall [17], and Rosenfeld [18], have been widely employed due to their simplicity and effectiveness.

Another popular approach is the medial axis transform (MAT) [19], which represents objects as their skeletal structure consisting of curves or points that lie along the medial axis. The MAT provides a concise representation of object shapes and enables robust shape analysis and matching.

Several variants and enhancements to skeletonization methods have been proposed. This includes incorporating distance metrics to refine skeletonization results, handling complex object topologies, and considering multi-scale skeleton representations for better characterization of objects.

Skeletonization methods have found applications in various fields, including shape analysis, object recognition, fingerprint recognition, and medical image analysis. They provide valuable insights into object structure and facilitate efficient object representation and matching algorithms.

In recent years, with the advancements in deep learning, there has been increasing interest in combining skeletonization methods with deep neural networks to leverage the benefits of both approaches, enabling more accurate and robust object recognition and analysis.

In summary, skeletonization methods have been extensively studied and applied in image processing and computer vision. They offer powerful tools for extracting the structural representation of objects, enabling shape analysis, recognition, and other applications. Ongoing research continues to explore novel techniques and integration with deep learning approaches to further enhance the capabilities of skeletonization methods.

2.3. Experiments

2.3.1. Approach overview

This article presents a formal study on digit classification using a similarity metric under various lighting conditions. The recognition process involves utilizing a paper sheet containing digits placed in front of a web camera. The digits are displayed in Times New Roman font with a font size of 120. To establish ground truth, each digit is resized to a 30x40px dimension and saved with its corresponding class number ranging from 0 to 9.

During the testing phase, the web camera captures the frame focused on the paper sheet. Subsequently, the captured image is converted to grayscale and transformed into a black-and-white representation using Otsu thresholding [20]. The Canny edge detection algorithm [21] [22] is applied to extract the edges of the objects from the image. These edges are then used to identify contours [23]. Contours that are deemed too small or located on the image's edges are filtered out of the classification pipeline. For each remaining digit's contour, skeletonizing and thinning algorithms such as Guo-Hall [17], Pavlidis contour tracing algorithm [24], Median Axis Transform [19], and Zhang-Suen skeletonization algorithm [15] [16] are applied. Each resulting skeleton is compared with the ground truth classes using the SSIM (Structural Similarity Index) metric [25]. The predicted label for each algorithm is determined based on the skeleton with the highest SSIM value. In case of a tie, the majority rule is employed to select the label among the values obtained from the algorithms.

The experiments were conducted in the shadowed room under several lighting conditions. The amount of light was measured using a light meter on two different surfaces: one with objects positioned directly facing the window and another with the surface rotated at a right angle (90 degrees) to the window. The results of the measurements are presented in the Table 1. The weather conditions during the experiment consisted of sunny skies without any clouds. All experiments were conducted perpendicular to the window.

For this article, only results from different amount of light at the surface rotated to from the window have been selected (14:30, 18:30, 20:00).

Table 1. Lighting on the objects

Time	Amount of light, Lux (surface at the right angle to the window)	Amount of light, Lux (surface faced to the window)
12.30	250	900
14:30	270	1000
16:30	270	1100
18:30	250	950
20:00	220	850

2.3.2. Experiments

Experiments at different light conditions 1 (14:30, 270 lux)

All experiments have been conducted during the good light conditions. During the time testing was performed (14:30 – 20:00) the amount of light has decreased from 270 lux to 220 lux. However, on all of the test images digits are well distinguishable and skeletonized.

The first experiment (lighting 270 lux) is presented in Figures 2-5.

The second experiment (lighting 250 lux) is presented in Figures 6-9.

The first experiment (lighting 220 lux) is presented in Figures 10-13.

Digits classification

All images have common problem – skeletons of digits 1 and 7 are very similar. So, SSIM tends to have high value for digit 1 and ground truth 7. Therefore, as number of images increases – classification accuracy is approaching to 90%.
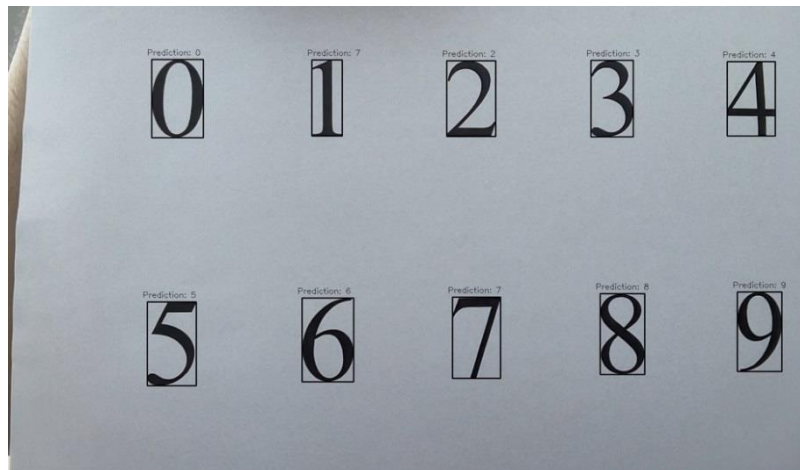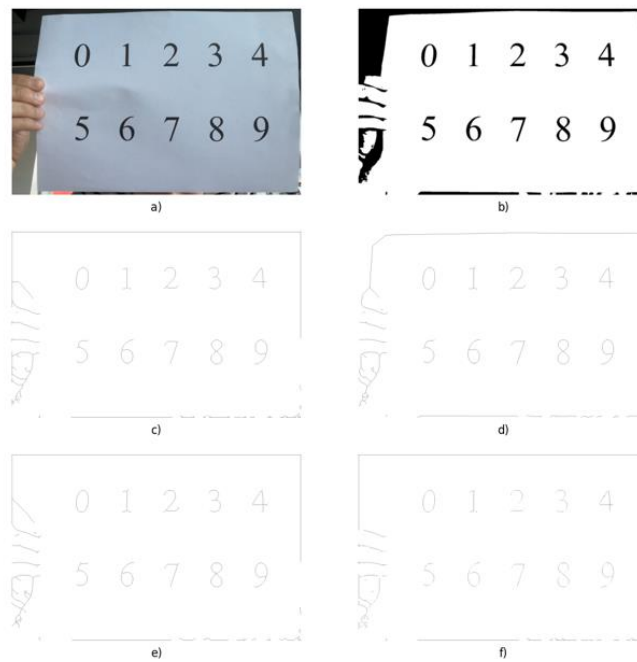
Fig 1. Result of digits classification

Fig. 2. (a) original image; (b) black-and-white image; (c) Guo-Hall carcass; (d) Pavlidis thinning; (e) MAT carcass; (f) Zhang-Suen carcass at 270 lux
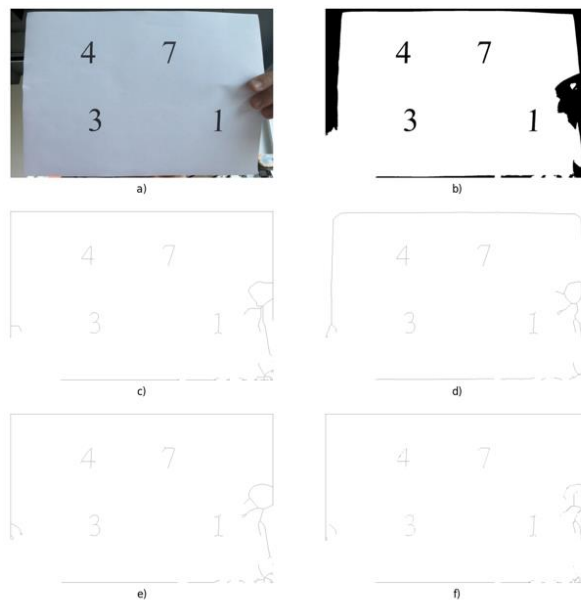
Fig. 3. (a) original image; (b) black-and-white image; (c) Guo-Hall carcass; (d) Pavlidis thinning; (e) MAT carcass; (f) Zhang-Suen carcass at 270 lux
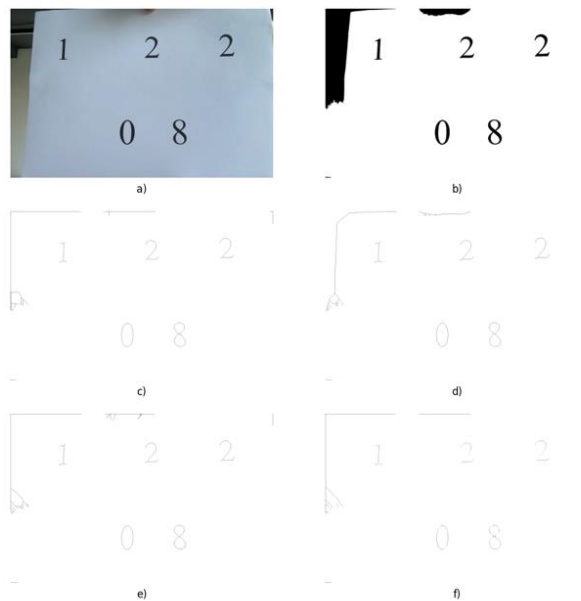

Fig. 4. (a) original image; (b) black-and-white image; (c) Guo-Hall carcass; (d) Pavlidis thinning; (e) MAT carcass; (f) Zhang-Suen carcass at 270 lux
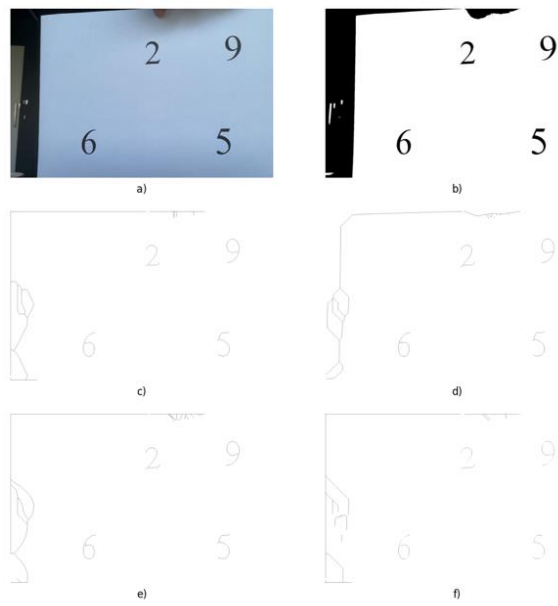
Fig. 5. (a) original image; (b) black-and-white image; (c) Guo-Hall carcass; (d) Pavlidis thinning; (e) MAT carcass; (f) Zhang-Suen carcass at 270 lux
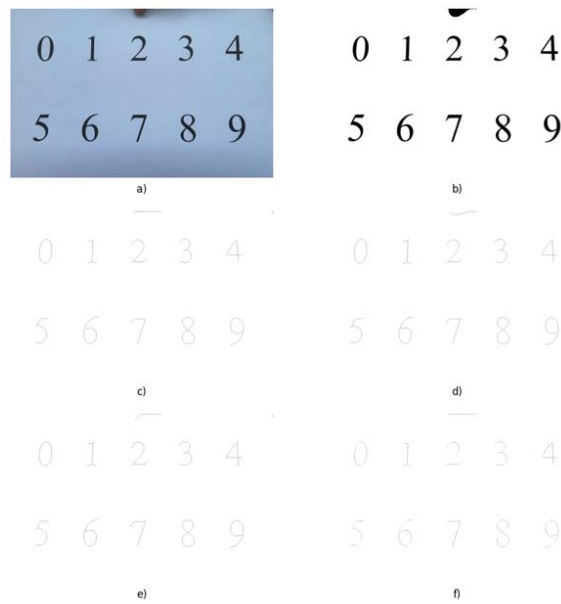

Fig. 6. (a) original image; (b) black-and-white image; (c) Guo-Hall carcass; (d) Pavlidis thinning; (e) MAT carcass; (f) Zhang-Suen carcass at 250 lux

Fig. 7. (a) original image; (b) black-and-white image; (c) Guo-Hall carcass; (d) Pavlidis thinning; (e) MAT carcass; (f) Zhang-Suen carcass at 250 lux

Fig. 8. (a) original image; (b) black-and-white image; (c) Guo-Hall carcass; (d) Pavlidis thinning; (e) MAT carcass; (f) Zhang-Suen carcass at 250 lux
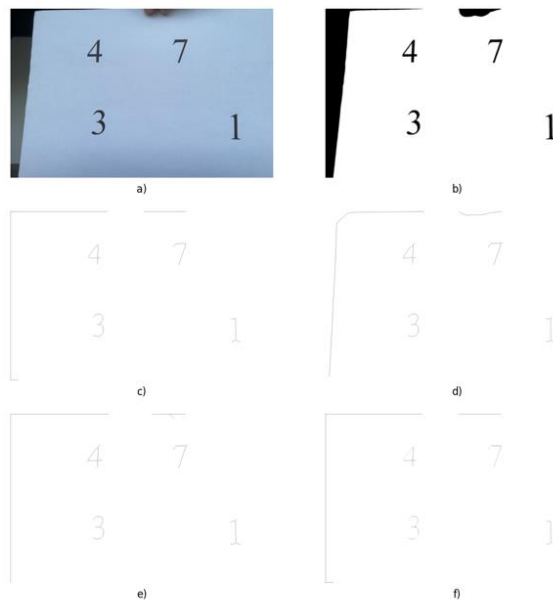
Fig. 9. (a) original image; (b) black-and-white image; (c) Guo-Hall carcass; (d) Pavlidis thinning; (e) MAT carcass; (f) Zhang-Suen carcass at 250 lux

Fig. 10. (a) original image; (b) black-and-white image; (c) Guo-Hall carcass; (d) Pavlidis thinning; (e) MAT carcass; (f) Zhang-Suen carcass at 220 lux
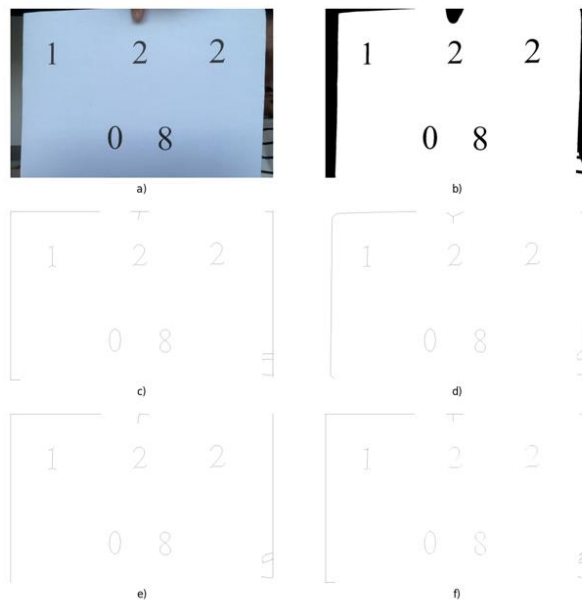
Fig. 11. (a) original image; (b) black-and-white image; (c) Guo-Hall carcass; (d) Pavlidis thinning; (e) MAT carcass; (f) Zhang-Suen carcass at 220 lux

Fig. 12. (a) original image; (b) black-and-white image; (c) Guo-Hall carcass; (d) Pavlidis thinning; (e) MAT carcass; (f) Zhang-Suen carcass at 220 lux

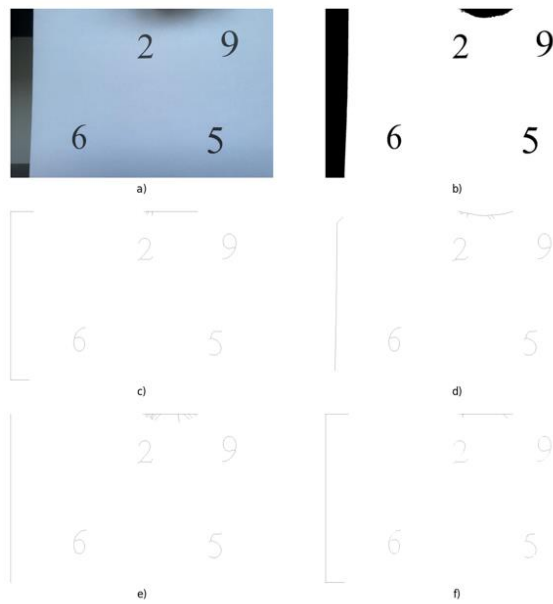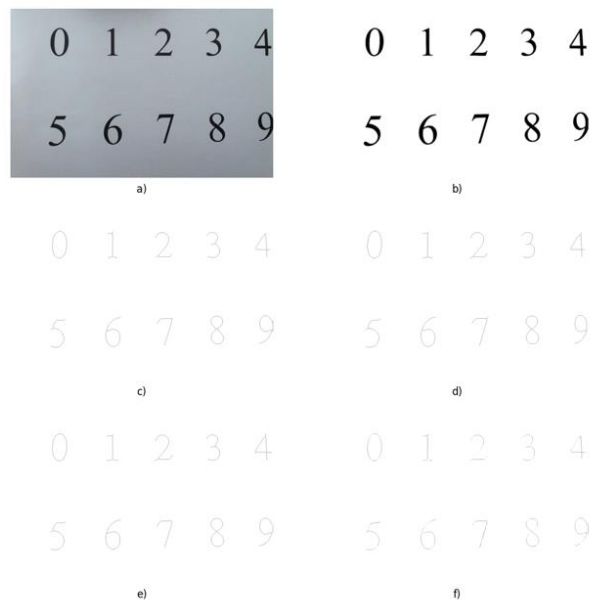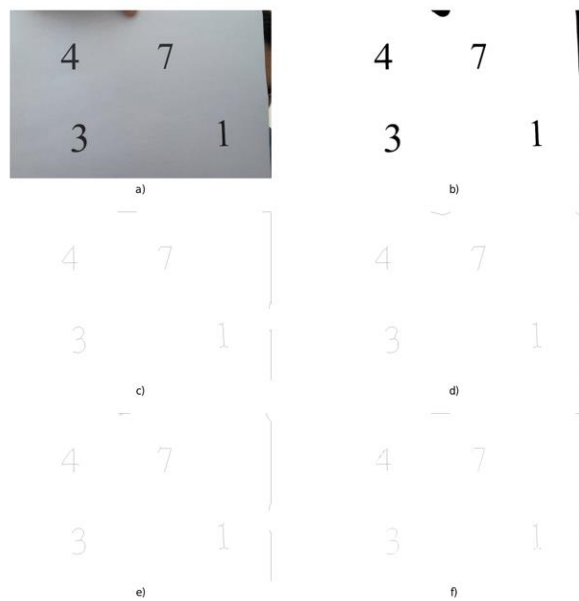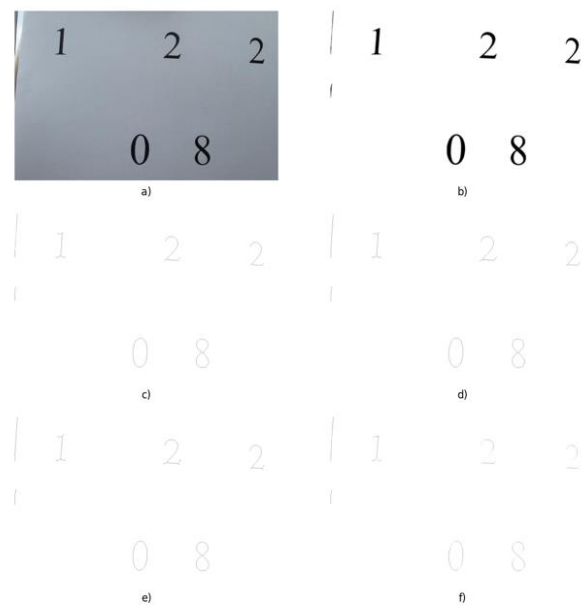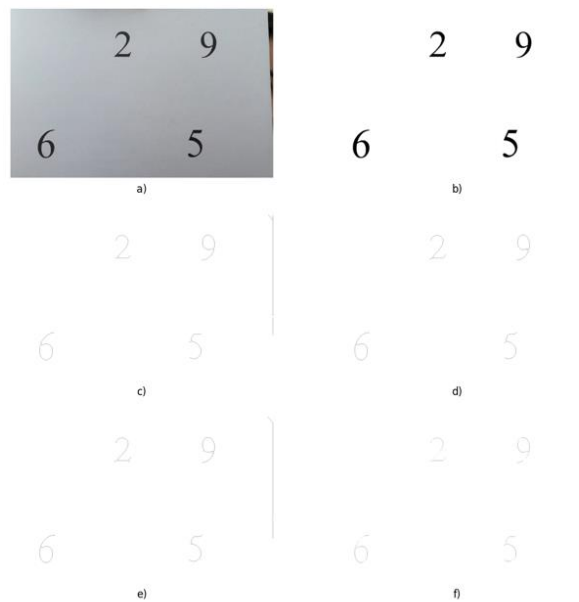**Fig. 13.** (a) original image; (b) black-and-white image; (c) Guo-Hall carcass; (d) Pavlidis thinning; (e) MAT carcass; (f) Zhang-Suen carcass at 220 lux

2.4. Conclusions

The conducted experiments showed similar results in digits classification SSIM score based on multiple thinning algorithms, such as Guo-Hall, Pavlidis contour tracing algorithm, Median Axis Transform, and Zhang-Suen skeletonization algorithm. There is a common problem for all of them – skeletons of digits 1 and 7 are similar. Therefore, SSIM tends to have higher values for classes 1 and 7, while classifying digit 1, what leads to incorrect decisions.

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20. ARTIFICIAL INTELLIGENCE AND INTERNATIONAL BUSINESS: RISKS AND OPPORTUNITIES

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In business, artificial intelligence has a wide range of uses. In fact, most of us interact with AI in some form or another on a daily basis. From the mundane to the breathtaking, artificial intelligence is already disrupting virtually every business process in every industry. As AI technologies proliferate, they are becoming imperative to maintain a competitive edge. "Artificial intelligence" is a broad term that refers to any type of computer software that engages in humanlike activities – including learning, planning and problem-solving [1].

Artificial intelligence (AI) was developed in the 1950s but has only become commonplace in recent years thanks to rapid advances in computational power, data availability, and machine learning techniques. AI is a general-purpose technology, like the steam engine and electricity, and it is expected to fundamentally change the economy [2]. It has the potential to improve welfare and well-being, including by increasing innovation and productivity, but equally raises major policy challenges, including concerns that it may exacerbate economic inequalities, and undermine democracy and human rights [3].

Although there is no agreed definition of AI, it is generally understood as the development of computer programmes that can undertake tasks and solve problems that usually require human intelligence. AI works by processing data through advanced algorithms, combing large datasets, and learning from the patterns or features in the data. Technologists differentiate between 'narrow AI', which is able to carry out discrete tasks such as translation, and 'general AI', which does not yet exist and where the level of intelligence would approximate that of a human.

Generative AI is a kind of artificial intelligence that generates different types of data, such as audio, images, text, code, and more, using existing data as inspiration and generating new results. In this case, ChatGPT is one, but not the only, representative of the industry that provided a consumer-friendly example of how generative artificial intelligence technology works [4]. And the breakneck pace of

adoption of generative artificial intelligence we are witnessing right now is just the beginning. According to Gartner forecasts, by 2025 generative artificial intelligence will account for 10% of all generated data. For comparison, today this figure is less than 1% [5].

As Emily Jones research has revealed, trade policy has important ramifications for AI governance, in ways that are often under-appreciated [3]:

– The international guidelines and standards for AI, over which major technology firms and governments are vying for influence, are voluntary but acquire substantial weight when they are cross-referenced in trade agreements. As international standards cover AI uses and processes, it is important that they reflect public interests, yet standard-setting is dominated by major industry players and a select number of governments.

– AI technologies are being granted additional intellectual property rights through trade agreements, including for algorithms and source code, which risks reinforcing the market power of dominant firms and impeding moves towards algorithmic transparency and accountability.

– AI technologies exhibit network effects and economies of scale and scope, amplifying concentration in digital markets. Given the global scale of major digital firms, international cooperation is vital for promoting competition in digital markets, yet cooperation is in its infancy, and rules to address market dominance by private actors remain a lacuna in international trade law.

– As the result of digitalization, consumers and workers are engaging directly in cross-border economic transactions to a greater extent than ever, benefitting from the efficiencies of algorithmic systems but also exposed to cross-border algorithmic harms. To uphold the rights of consumers and workers, new forms of international regulation and cooperation will be needed, yet this is only starting to be recognized.

– An increasing number of trade agreements include commitments on cross-border data flows, which are vital for the functioning of AI technologies; a few also promote open government data further promoting AI innovation. Yet, they do little to strengthen personal data protection, even though the acquisition and control over data can undermine the privacy of citizens; nor do they address the privileged control over datasets by major technology companies, which can act as a barrier to entry for smaller AI firms.

Machine learning is one of the most common types of AI in development for business purposes today. Machine learning is primarily used to process large amounts of data quickly. These types of AIs are algorithms that appear to "learn" over time. If you feed a machine-learning algorithm more data its modeling should improve. Machine learning is useful for putting vast troves of data – increasingly captured by connected devices and the Internet of Things – into a digestible context for humans. For example, if you manage a manufacturing plant, your machinery is likely hooked up to the network. Connected devices feed a constant stream of data about functionality, production and more to a central location. Unfortunately, it is too much

data for a human to ever sift through; and even if they could, they would likely miss most of the patterns [1].

Machine learning can rapidly analyze the data as it comes in, identifying patterns and anomalies. If a machine in the manufacturing plant is working at a reduced capacity, a machine-learning algorithm can catch it and notify decision-makers that it is time to dispatch a preventive maintenance team. But machine learning is also a relatively broad category. The development of artificial neural networks – an interconnected web of artificial intelligence "nodes" – has given rise to what is known as deep learning.

Deep learning is an even more specific version of machine learning that relies on neural networks to engage in what is known as nonlinear reasoning. Deep learning is critical to performing more advanced functions – such as fraud detection. It can do this by analyzing a wide range of factors at once.

For instance, for self-driving cars to work, several factors must be identified, analyzed and responded to simultaneously. Deep learning algorithms are used to help self-driving cars contextualize information picked up by their sensors, like the distance of other objects, the speed at which they are moving and a prediction of where they will be in 5-10 seconds. All this information is calculated at once to help a self-driving car make decisions like when to change lanes.

Deep learning has a great deal of promise in business and is likely to be used more often. Older machine-learning algorithms tend to plateau in their capability once a certain amount of data has been captured, but deep learning models continue to improve their performance as more data is received. This makes deep learning models far more scalable and detailed; you could even say deep learning models are more independent.

Rather than serving as a replacement for human intelligence and ingenuity, artificial intelligence is generally seen as a supporting tool. Although AI currently has a difficult time completing commonsense tasks in the real world, it is adept at processing and analyzing troves of data much faster than a human brain could. Artificial intelligence software can then return with synthesized courses of action and present them to the human user. In this way, we can use AI to help game out possible consequences of each action and streamline the decision-making process.

Those traits make AI highly valuable throughout many industries – whether it is simply helping visitors and staff make their way around a corporate campus efficiently, or performing a task as complex as monitoring a wind turbine to predict when it will need repairs.

Some of the most standard uses of AI are machine learning, cybersecurity, customer relationship management, internet searches and personal assistants.

As Nicholas Crafts research has revealed, cheerleaders for AI expect it to be a GPT (general-purpose technology) driving a 'Fourth Industrial Revolution'. Earlier industrial revolutions are also often thought to be associated with classic GPTs: steam with the First Industrial Revolution, electricity with the Second Industrial Revolution, and ICT with the Third Industrial Revolution. For an economic historian, however, this does not do justice to the concept of an 'industrial revolution' which entails a

significant change in the methods of generating advances in technology rather than faster technological progress and an acceleration in the rate of productivity growth *per se* [6].

According to the authors of Notes From The AI Frontier: Modeling the Impact of AI on the World Economy, the net productivity effect of using AI accumulates over time – it is small at first, but substantial in the future. The contribution of artificial intelligence to economic growth could be three times higher by 2030 than in the coming years. The global net value added impact of 13 trillion US dollars compared to today's global GDP is likely to develop over a longer period [7].

According to Mohylevska, O., Slobodianyk, A. & Sidak, I. the authors of Notes From The AI Frontier provide an annual trend curve, it is mostly for illustration and modeling purposes. As the authors note, the modeling depends on the actual level of AI adoption by firms, and the current firm-level data set may be biased towards early adopters. This may mean that there is an overestimation of the impact [8].

Artificial intelligence is transforming our world in countless ways, from automating mundane tasks to revolutionizing healthcare and transportation. The concept of ethical use of artificial intelligence focuses chiefly on the worries that AI, improperly implemented, can violate the rights of citizens and workers and, more broadly, human rights in general. Secondly, there is a concern that AI, already in the progress of pushing lower-skill workers out of their jobs, will begin to affect ever more advanced fields. This shift in employment can have serious ethical concerns where automation comes at the direct cost of human living. This is of greatest importance to those places that rely on more production-oriented industries, particularly in the global south [9].

According to Kusherets, D. & Khmara, M. several directions of research in the field of artificial intelligence are singled out [10]:

- machine reasoning (covers the processes of planning, presentation of knowledge and reasoning, search and optimization);

- machine learning (is conditionally divided into deep learning and reinforcement learning);

- robotics (includes control, situational perception, sensors and actuators, as well as the integration of all other methods into cyber-physical systems).

Ukraine is one of the leading suppliers of AI technologies in Eastern Europe and the world. Now IT is an export industry for the country. Thus, it is logical that the more successful the development of the IT market will be, the more successful the growth of the national gross product will become. As regards global trends, the Ukrainian market develops synchronously, that is, it has the most innovators in those areas that are most popular in the world.

In addition, the fact that six of the top 30 companies that supply AI technologies are Ukrainian speaks for itself. Ukraine has great potential for development in the field of artificial intelligence technologies, but this sector needs to be established and promoted to the masses.

As Thormundsson, B. research has revealed, the software segment in the global military artificial intelligence (AI) and cybernetics market was the largest market segment as it brought in the most revenue in 2018 and is also anticipated to bring in the most revenue in 2024 at 8.07 billion U.S. dollars. All segments in the military AI market are expected to increase by 2024 [11].

According to Hrushchynska, N.M., digital markets, a virtual economy, artificial intelligence require an appropriate response to the introduction of emotional intelligence as the ability of an individual to manage the emotional sphere based on intellectual analysis [12].

The problem of emotional intelligence requires further research both theoretically and experimentally. The educational system with the introduction of innovation and creative approaches is designed to find a balance between thinking and emotions.

Emotion AI is a category of AI that allows computer systems and algorithms to recognize and interpret human emotions by tracking facial expressions, body language, or speech. Emotion AI can be described as a tool that provides a more casual interaction between machines and people: it can analyze the most subtle changes in human facial expressions (microexpressions), voice patterns, gestures and react to them in a human-like manner [13].

According to forecasts, the global market of emotion detection and recognition technology will reach 56.0 billion US dollars by 2024, compared to 21.6 billion US dollars in 2019. In the software product segment, face and emotion recognition technology will grow at the fastest pace over the forecast period.

A. Lieberman, who justifies the concept of combining artificial and emotional intelligence, believes that a correct understanding of emotions can simplify decision-making and create much better models of "next-best-action", which improve interaction with a specific person who is experiencing a certain mood. Taking it a step further – the use of emotional intelligence as part of artificial intelligence can help to achieve unique results.

The idea is that artificial intelligence can automate many operational processes to save money and improve productivity. AI can even be used during certain customer requests. However, it should be remembered that human behavior is not always logical. Therefore, when people interact with purely logical systems, the results can be difficult to predict.

To meet these needs, as well as to assess customer sentiment and personality type, AI + EI customer service systems (a combination of artificial and emotional intelligence) are employed. Thus, processes are automated and financial benefits are obtained as a result of adding EI to personal, intellectual and client-oriented approaches [14].

According to Next Move Strategy Consulting the market for artificial intelligence is expected to show strong growth in the coming decade. Its value of nearly 100 billion U.S. dollars is expected to grow twentyfold by 2030, up to nearly two trillion U.S. dollars. The AI market covers a vast number of industries.

Everything from supply chains, marketing, product making, research, analysis, and more are fields that will in some aspect adopt artificial intelligence within their business structures [15].
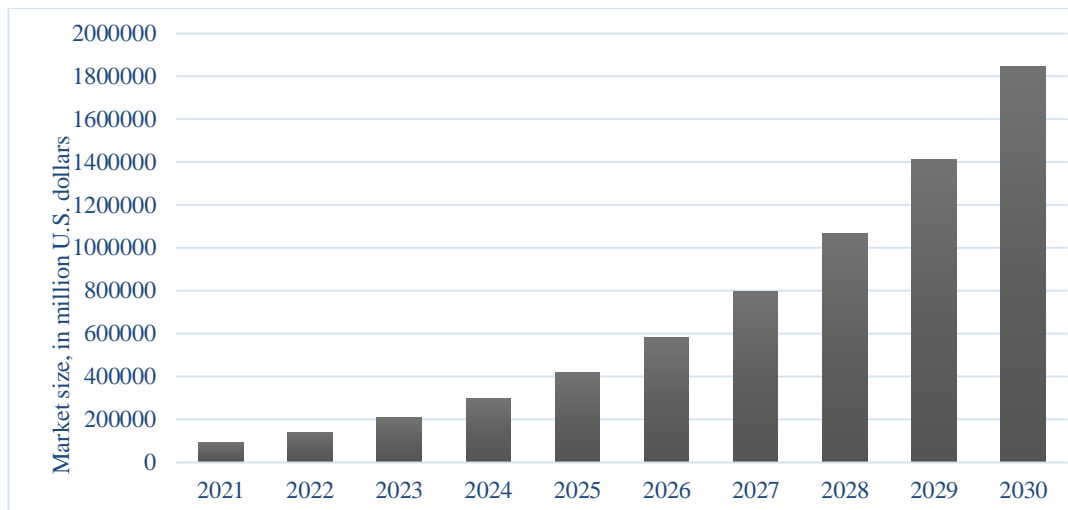
Figure 1. Artificial intelligence (AI) market size worldwide in 2021 with a forecast until 2030 *(in million U.S. dollars)*

Source: Next Move Strategy Consulting

Cybersecurity remains the primary target of mitigation for organizations adopting artificial intelligence (AI) within their business in 2022. Over half the businesses surveyed responded that they were taking steps to mitigate cybersecurity risks. This is likely because the recent nature of AI along with a desire to keep enterprise interests secret means businesses keep a close eye on the risk of adopting new programs. Political stability and national security were the least of business concern, with less than ten percent of businesses attempting to mitigate such problems when adopting AI.

Figure 2. Global risks being mitigated by organizations when adopting artificial intelligence (AI) in 2022

Combined, China had the highest rate of exploring and deploying artificial intelligence (AI) globally in 2022. It was followed closely by India and Singapore. This lead was also marked when accounting only for the deployment of AI in organizations in China, with India following. Both n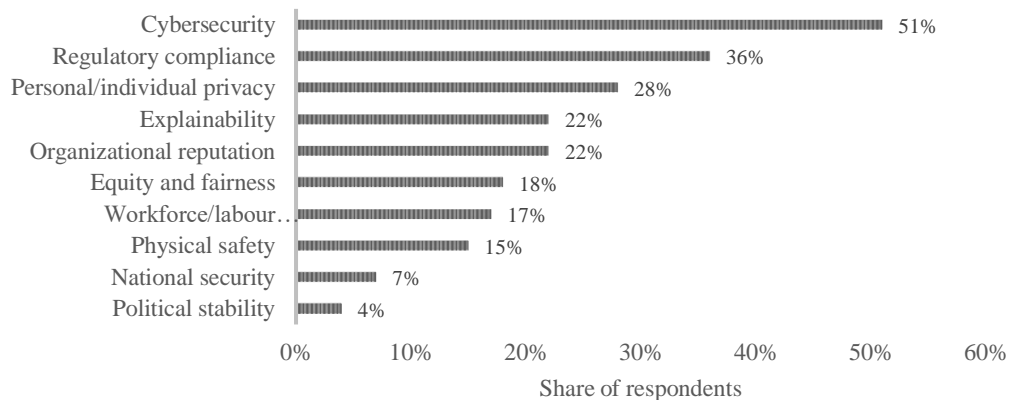ations had a nearly 60 percent deployment rate. When accounting only for exploration, however, the leading nations were Canada and the United States [16].

Despite the continent often being overshadowed by its cross-Atlantic neighbor – the United States – Europe still contains an exceptionally vibrant technology sector. Europe's companies and knowledge reservoirs contain enough critical mass of technical know-how to compete with global competitors. This remains true in the field of artificial intelligence (AI), where funding for startups specializing in this high-demand technology stood at more than 1.4 billion U.S. dollars in late 2022. Many of Europe's major economies are leaders in the exploration and deployment of AI, with developments being, in general, ahead of the global average.

Germany remains Europe's largest economy and comes in fourth globally only behind the juggernauts of the United States, China, and the - ever industrious - Japan. Germany is therefore no slouch in information technology development. Despite this, only a share of German companies aim to substantially invest in AI in 2023, or around a third of companies. For most German enterprises the use of AI is expected to not take off significantly in the near future. Nonetheless the companies that expect to use AI in their daily business can reap considerable benefits. Whether it be improved processes, quicker analysis, or simply avoiding human errors, those businesses that aim to adapt AI in the coming years will be ahead of the curve in developments.

The Nordic countries of Sweden, Denmark, Norway, Finland, and – though significantly smaller – Iceland, are advanced users and developers of AI within their enterprises. More than a third of organizations in the Nordics consider AI to be integral in their day-to-day business and less than five percent are not using it. The larger Nordic nations also possess robust and diverse educational programs focused on exploring the many possibilities of AI usage. Denmark, in particular, possesses 19 Master's degree programs only in the field of AI. This, combined with a remarkably high economic clout, due to each of the Nordics being on the top 20 list of GDP per capita, means any interest in European technological development would do well with looking at the Nordic region.

Currently, there is a lot of debate among experts about the quality of information generated by AI and whether businesses should use the power of artificial intelligence to solve such complex issues as consumer behaviour research in the consumer market. Recent studies claim that AI increases productivity and significantly affects microeconomic processes, which leads to certain economic consequences.

Experts' forecasts differ on how artificial intelligence will affect the global economy in the future. It is predicted that by 2030, global gross domestic product

could grow by 14% (equivalent to USD 15.7 trillion) as a result of accelerated development and implementation of AI. This will facilitate standardisation and automation, as well as improve the personalisation of products and services.

Due to the rapid spread of artificial intelligence technology, its use is becoming almost mandatory to increase competitive advantage in the market. Rather than serving as a replacement for humans, AI is generally seen as a complementary technology. Artificial intelligence still finds it difficult to perform some of the tasks that humans are used to in the real world, but it can process and analyse data sets much faster than the human brain. Businesses can already use artificial intelligence to determine the possible consequences of each action and simplify the decision-making process.

Ukraine is already an exporter of AI technologies and can become even a better one. Ukraine is an ideal location for innovation and has sufficient chances to become a unique place for smart solutions in the field of artificial intelligence and its proper functioning.

However, for this, the country must first solve a number of problems, such as ignorance of producers and consumers, mistrust of people, bureaucracy in large companies, lack of properly structured data, vague legislation, etc. In order to alter people's perception of AI technologies, it is necessary to introduce significant changes, especially in government policies.

The number of areas of AI technology application is increasing every day. For instance, the use of artificial intelligence in defense and military affairs, in education, in business, in the fight against fraud, in electric power, in the production sphere, in banks (risk management, forecasting, chat-bots in mobile banking applications), in transport, in logistics, in production (control of production processes, their optimization, equipment testing, information about breakdowns, preventive measures, automation), in trade (analysis of purchasing activity and effectiveness of marketing strategies, procurement management, development of personalized loyalty programs, deep analytics), in the market of luxury goods and services, in public administration, in housing and communal services, in forensics, in the judicial system, in sports, in medicine (documentation, diagnostics), in the field of information security (technologies for combating fraud, analysis of old threats and prevention of new ones, information to create a common database), for analysis of the behavior of citizens, in the development of culture, etc.

The capabilities of artificial intelligence include:

- an increase in business productivity due to widespread automation of basic business processes (including the use of robots and autonomous transport systems);

- a rise in demand for products and services of companies due to their personalization and individual approach to each client (in particular, the use of AI assistants and analytical programs);

- automation of online audience filtering processes, selection of potential customers;

- automation of application, order and sales processes;

- security control and implementation of a smart authentication system.

The term "artificial intelligence" appeared in 1956, but AI technology has only gained in popularity today against a background of increasing data volume, improving algorithms, optimizing computing power and data storage facilities. Currently, AI includes appropriate software systems and algorithms that can perform any tasks similar to ones the human mind can do; the behavior of such systems and algorithms is oriented towards a certain goal.

The introduction of AI requires a significant change in business processes, and new solutions using AI technologies can lead to the creation of new business processes that open up new business opportunities: an influx of customers, bigger profits, increased loyalty, etc.

The artificial intelligence market is developing at a rapid pace. According to Next Move Strategy Consulting the market for artificial intelligence is expected to show strong growth in the coming decade. Its value of nearly 100 billion U.S. dollars is expected to grow twentyfold by 2030, up to nearly two trillion U.S. dollars. The AI market covers a vast number of industries. Everything from supply chains, marketing, product making, research, analysis, and more are fields that will in some aspect adopt artificial intelligence within their business structures.

Combined, China had the highest rate of exploring and deploying artificial intelligence (AI) globally in 2022. It was followed closely by India and Singapore. This lead was also marked when accounting only for the deployment of AI in organizations in China, with India following. Both nations had a nearly 60 percent deployment rate. When accounting only for exploration, however, the leading nations were Canada and the United States.

Despite the continent often being overshadowed by its cross-Atlantic neighbor – the United States – Europe still contains an exceptionally vibrant technology sector. Europe's companies and knowledge reservoirs contain enough critical mass of technical know-how to compete with global competitors. This remains true in the field of artificial intelligence (AI), where funding for startups specializing in this high-demand technology stood at more than 1.4 billion U.S. dollars in late 2022. Many of Europe's major economies are leaders in the exploration and deployment of AI, with developments being, in general, ahead of the global average.

Rather than serving as a replacement for human intelligence and ingenuity, artificial intelligence is generally seen as a supporting tool. Humans can use AI to game out possible consequences and streamline the decision-making process.

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21. TECHNOLOGIES CHANGING IT SERVICES IN THE ERA OF ARTIFICIAL INTELLIGENCE

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No one can deny that service is a work performed by humans. But technology can enhance services and even take over certain tasks. Technologies that facilitate digital transformation, in particular, can have a significant impact on how services are delivered and the customer experience.

Here are 8 technologies transforming IT services:

1. Search

When customers need help, their first instinct is to search online. Suppliers should ensure that their online company and product information is easy to find and is optimized for search so that the most relevant results appear first. Ideally, this information would be placed on the supplier's website and prompt visitors where to go or find it.

2. Chatbots

Most supplier websites offer a live chat option. However, instead of chatting with an attendant, users typically chat with a software program called a chatbot. This simple chatbot uses a set of programmed instructions and word matching to recognize questions and answer them. More advanced chatbots use artificial intelligence to understand the meaning of sentences and learn from question-and-answer sessions. In theory, chatbots can manage the highest number of simultaneous conversations, provide answers faster than humans, and handle customers' questions more patiently.

3. **Cloud Computing**

Cloud computing is a key factor in digital transformation. There are many cloud-based applications for IT service delivery tasks such as customer relationship

management, help desk, remote network management, etc. Service delivery often requires some kind of collaboration between support engineers and customers. Cloud environments provide convenient solutions for sharing documents, exchanging log files, storing historical data, and other collaborative tasks.

4. Augmented Reality (AR)

Although augmented reality (AR) has some application potential, its use in the service industry is still limited. For example, through glasses with augmented reality (AR) capabilities, remote experts can see what data center field engineers see in the field. Remote experts can provide instructions to field engineers and project them onto the field engineer's glasses. Another possibility is to use the camera on your smartphone or tablet to scan an image, barcode or QR code. Augmented reality (AR) software will recognize the image and overlay the information on the display, augmenting the live image with information from a database.

5. Virtual Reality (VR)

Virtual Reality (VR) is a technology that is still under development, but has come a long way over the years, depending on the application. Virtual reality (VR) can require a lot of computing power and bandwidth, making it unsuitable for use over long distances. However, it can help engineers perform certain tasks without the need for real-time production. In this way, the entire data center can be virtualized, making operations more efficient.

6. Mobile application

Almost everyone spends a lot of time on their smartphones, so customers expect to be able to use their phones to get in touch. Therefore, corporate websites need to be more mobile-friendly, and a mobile customer service app might be a good idea. Especially in IT services, where there is a lot of interaction between IT-savvy engineers, using mobile apps is probably the best mode of communication. Mobile apps also allow businesses to collect information about users and help customize the user experience.

7. Social Services

According to the survey, people spend an average of three hours a day on smartphones, and two hours are spent on social media. So customers need to communicate through social media like Facebook, WeChat or WhatsApp. Many companies already offer "social support" services, with varying degrees of success. To avoid annoying its customers, use social media for service and support only if it integrates its customers with other channels and backs it up with sufficient resources.

8. Internet of Things

Millions of sensors are connected to the internet for real-time remote monitoring. Engineers used to have to go on site to record measurements and forward this information to the control center. With the help of IoT, the control center can directly record information in real time, saving time and money, and improving the accuracy and quality of the process. For example, with smart meters, consumers do not have to record and report the gas or electricity usage displayed on the meter. This

utility enhances the customer experience by performing this remotely and informing consumers through an online dashboard.

ERP stands for Enterprise Resource Planning, but what is ERP used for? In its simplest definition, ERP considers all of the core business processes needed to run a company: finance, human resources, manufacturing, supply chain, service, procurement, and more. At its most basic functionality, ERP assists in the efficient management of all processes in an integrated system, often considered an organization's system of record.

Whether it is the automotive industry or the wholesale and retail industry, every industry needs accurate and timely information, as well as efficient business processes, in order to stand out from the competition and thrive. The ways in which ERP software is used and the core functions of each industry may vary greatly. The following are just a few examples:

Utilities need to constantly review their capital assets, not only to meet future service needs, but also to replace aging assets. Without ERP, prioritizing investments in these major assets would be a daunting challenge and prone to mistakes. ERP can also assist in solving other important utility organizational issues: spare parts forecasting, which can cause serious customer service problems if the appropriate parts are not available during an outage, but excess spare parts can lead to escalating costs and obsolete inventory.

On-time delivery is critical for wholesalers , importers, direct store delivery and 3PL/4PL companies. At the same time, these organizations are looking to reduce distribution costs, increase inventory turns, and reduce order-to-cash time. Achieving these goals requires the integration of inventory management, purchasing and logistics functions, as well as automation procedures tailored to the needs.

Discrete, batch, and continuous process manufacturers rely on ERP and supply chain systems to achieve product quality goals, manage asset utilization, control overtime costs, handle customer returns, and monitor inventory changes to accurately Identify and perform best and poor products, and manage purchasing more efficiently to gain end-to-end inventory visibility.

The service industry —including accounting, tax, engineering, IT, legal, and other professional services firms—needs powerful, real-time mobile ERP technology that balances service delivery commitments with financial health. The key to success in professional services is meeting deadlines while maintaining control over project profitability, resource utilization, revenue recognition, recurring revenue targets, and growth opportunities.

The retail industry has undergone a major transformation, and today's e-commerce combines other sales channels as well as brick-and-mortar outlets. Retailers must rely on consolidated data if they want to provide self-service options for identifying, configuring, sourcing and shipping. A modern ERP can help businesses reduce cart abandonment rates, improve website conversions, increase average order value, and further increase customer lifetime value.

The most commonly used ERP modules include:

Finance: The finance and accounting module is the cornerstone of most ERP systems. In addition to managing the general ledger and automating key financial work items, it can also assist companies in tracking accounts payable (AP) and accounts receivable (AR), and efficient settlement Accounting, generating financial statements, following revenue recognition standards, mitigating financial risk, and more.

Human resource management: Most ERP systems include a human resource module with core functions such as working hours, attendance records, and payroll. Extension suites, or even entire human capital management (HCM) suites, can interface with ERP and provide even more powerful HR capabilities, from workforce analytics to employee experience management.

Sourcing and Sourcing: The Sourcing and Sourcing module helps businesses source the materials and services they need to manufacture goods, or items they want to resell. The module centralizes and automates procurement operations, including requesting quotes, creating contracts, and approvals. This module can effectively reduce under-purchasing and over-purchasing, and use AI analysis to improve negotiations with suppliers, and even seamlessly connect to the buyer network.

Sales: The Sales module tracks communications with potential and existing customers and helps salespeople use data-driven insights to increase sales and lock in prospects with the right promotions and up-sell opportunities. The module also supports functionality for the order-to-cash process, including order management, contract signing, payment capture, sales performance management, and sales force support.

Manufacturing: The Manufacturing module is a key planning and execution suite of ERP software that helps companies streamline complex manufacturing processes and ensure production meets demand. This module usually includes functions such as material requirements planning (MRP), production scheduling, manufacturing execution, and quality management.

Logistics and supply chain management: Another key suite of ERP systems is the supply chain module , which can track commodity and supply changes throughout the organization's supply chain, support real-time inventory management, warehousing operations, transportation and logistics, and help improve the efficiency of the supply chain. Transparency and elasticity.

Service: ERP's service module helps companies create the dependable, personalized service customers expect. This module includes tools to manage in-house repairs, spare parts, field service management, and fee-for-service revenue streams. It also provides analytics to help service representatives and technicians resolve customer issues quickly and increase customer loyalty.

R&D and Engineering: A feature-rich ERP system also includes R&D and Engineering modules . This module provides tools for product design and development, product lifecycle management (PLM), product regulatory compliance, etc., allowing companies to implement innovations quickly and cost-effectively.

Enterprise Asset Management: A powerful ERP system can include an EAM module to help asset-intensive enterprises minimize downtime and keep machines and equipment at peak performance. This module includes functions such as predictive maintenance, scheduling, asset operation and planning, environment, health and safety (EHS).

Digital transformation is accelerating, and ERP is at the core. When digital technology is adopted in every department of a business, it can revolutionize the way it operates.

One of Gartner's core digital business accelerators is "elimination of delays," or in other words, the elimination of any negative factors that slow down business efficiency, including outdated processes and systems. So it's not hard to understand why companies are looking for more powerful ERP systems.

Here are three trends we can observe today:

The cloud era is coming: The trend of adopting cloud ERP will continue to rise, because more and more companies realize the advantages of cloud, including access anytime and anywhere, reduce hardware and technical support costs, improve security, and integrate other systems , and these are just a few of the benefits. Panorama Research mentioned in the 2020 ERP report: "More than half of organizations choose to use cloud software (63%) instead of deploying software on-site (37%)." In today's enterprises seeking to improve efficiency, cloud systems are no longer possible missing technology.

Vertical Integration: The dilemma between a premium solution and an integrated ERP is no longer an option, and going forward we believe businesses will need the best of both worlds: a fully integrated ERP system with vertical scalability. In this way, companies can obtain the specific functions they need, and there will be no difficulty in integrating data due to scattered information islands. In addition, we also expect greater flexibility in the new architecture to tailor business processes to individual company needs.

User personalization: Employees, customers, and suppliers all expect content and features that match their specific needs or interests, thereby increasing productivity. And demographic changes in the workforce, especially in industries such as manufacturing, are also driving demand for low-code/no-code platforms. These platforms allow users to get the experience they want without having to adapt to software. Users can also expect to enjoy customizable dashboards, AI-guided search, personalized chat and personalized workflows across devices.

Explore more ERP technology trends and learn how to systematically evaluate your product choices, avoid pitfalls, and drive the right enterprise innovations.

ERP is not only suitable for global enterprises, SAP can provide suitable ERP solutions for small, medium and large enterprises, and you can also obtain industry and company-specific functions to meet exclusive business needs. Regardless of your company's business sector and size, it is recommended to follow best practices and carefully plan your ERP implementation project.

Small business ERP

The ERP system for small businesses can help you flexibly manage all aspects of your company's rapid expansion: from sales and customer relations, to finance and operations, without relying on spreadsheets anymore. Small business ERP tools usually adopt a cloud architecture, which is not only quick to install, but also can be expanded as needed to grow and thrive with you.

Medium Enterprise ERP

Today's ERP enables medium-sized companies or subsidiaries to enjoy various advantages, including built-in analysis, rapid deployment and best practices of dozens of enterprise processes, including: finance, HR, supply chain management, etc. Midsize business ERP tools help growing businesses scale and become more competitive, even with limited resources. The enterprise ERP system with modularization and cloud architecture is also a popular choice for medium-sized companies with complex processes or expecting rapid growth.

Large companies with global or subsidiary operations need market-leading ERP systems with built-in AI, machine learning and analytics capabilities , and use intelligent automation to revolutionize business models and processes. ERP systems can be deployed on-premises, in the cloud, or in a hybrid environment depending on business needs. They can integrate with existing databases, or run on newer, powerful in-memory databases .

Many companies are embarking on the journey of modernizing on-premises ERP systems and upgrading to cloud-based deployments, which requires careful planning of ERP upgrades , careful evaluation of ERP software , and examination of deployment options .
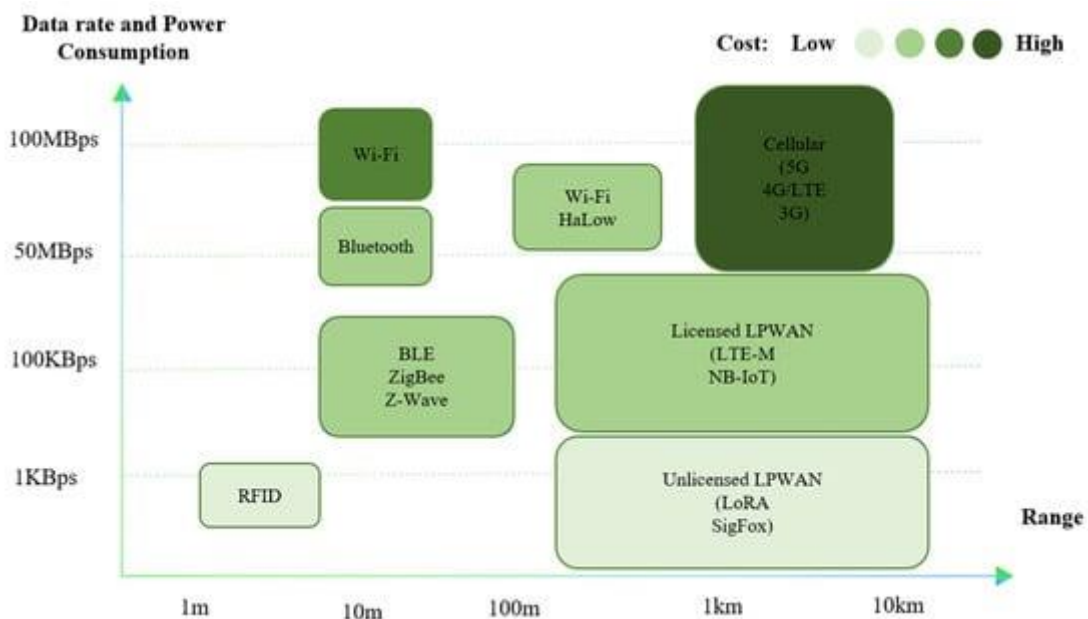

Figure 1. Comparison of date rate, power consumption, cost, and a coverage range of available communication technologies.

The influence of information technologies (IT) on IT services in the era of artificial intelligence (AI) is characterized by several notable peculiarities and transformative trends:

Automation and Efficiency: AI technologies are driving automation in IT services. Routine tasks such as system monitoring, patch management, and troubleshooting can be automated with AI-driven tools, improving efficiency and reducing the need for manual intervention.

Predictive Maintenance: AI can predict when IT systems and hardware are likely to fail, enabling proactive maintenance. This minimizes downtime and service interruptions, leading to improved reliability.

Advanced Analytics: AI and machine learning enable IT services to perform advanced data analytics and gain insights into system performance, user behavior, and security threats. This data-driven approach enhances decision-making and problem-solving.

Enhanced Security: AI plays a significant role in cybersecurity. It can detect and respond to threats in real-time, helping IT services to protect systems and data more effectively.

Chatbots and Virtual Assistants: AI-powered chatbots and virtual assistants are increasingly used in IT service desks to handle routine user inquiries and provide self-service options. This reduces the workload on human support agents.

Customization and Personalization: AI allows IT services to tailor solutions to individual user needs. For example, AI-driven recommendation systems can suggest personalized software or hardware configurations.

Scalability: AI can adapt to changing workloads and scale resources up or down as needed, making IT services more flexible and cost-effective.

Natural Language Processing (NLP): NLP technology enables better communication between users and IT systems. Users can interact with IT services using natural language, making it easier to request assistance and receive relevant information.

Reduced Human Intervention: While AI automation can improve efficiency, it can also lead to a reduction in the need for human intervention in some areas of IT services. This has implications for the job roles and skillsets required in the IT industry.

Ethical and Bias Concerns: AI in IT services raises ethical concerns related to bias in algorithms, privacy, and transparency. Addressing these concerns is essential to maintain trust in IT services.

Continuous Learning: AI systems require ongoing training and updates to remain effective. IT professionals must stay current with AI technologies and adapt to evolving requirements.

Cost Savings and ROI: While implementing AI in IT services can involve initial costs, it often leads to long-term cost savings through improved efficiency, reduced downtime, and better resource utilization.

Data Management: The proliferation of AI in IT services generates vast amounts of data. Proper data management and governance are crucial to ensure data quality, security, and compliance.

Interoperability: Integrating AI tools and services with existing IT infrastructure can be challenging. Ensuring interoperability and compatibility is essential for a seamless transition to AI-enhanced IT services.

Skills Gap: There is a growing demand for AI-related skills in the IT industry. Organizations may need to invest in training and development to bridge the skills gap and fully leverage AI technologies.

In summary, AI is reshaping IT services by automating tasks, improving efficiency, enhancing security, and providing new capabilities. However, it also brings challenges related to ethics, skills, and integration. To harness the benefits of AI, IT professionals and organizations must adapt to these changes and navigate the evolving landscape effectively.

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22. THE INFLUENCE OF THE TRADE AND ECONOMIC RELATIONS BETWEEN UKRAINE AND THE EUROPEAN UNION ON THE DOMESTIC PRACTICE OF TARIFF AND NON-TARIFF REGULATION AND FOREIGN ECONOMIC ACTIVITIES OF ENTERPRISES

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Highlights the impact of foreign trade on the improvement of tariffs and non-tariff methods of regulating foreign economic activity in Ukraine. At the same time, using systematic and synergistic approaches and methods of analysis and synthesis, induction and deduction, historical and comparative analysis, **it was established** that relations between Ukraine and the European Union were initiated in December 1991, when the Minister of Foreign Affairs of the Netherlands as the country presi-ding over it your, letter on his **behalf officially recognized** the independence of Ukraine, and its policy regarding their development is carried out on the basis of the Law of Ukraine of July 1, 2010 «On the Principles of Internal and Foreign Poli-cy», according to Article 11 of which «... ensuring Ukraine's integration into the European political, economic and legal space» is one of the main political foundati-ons of its foreign policy [4]. In this context, we note **that foreign economic policy** is the activity of the state to regulate its economic relations with other countries, which is formed on the basis of the theory and practice of the market economy. The founda-tion of the state is the Constitution. Along with this, an important component of foreign economic policy is foreign trade, that is, such a set of principles and methods and tools of influence on the development of the country's foreign trade, which ensu-rens the achievement of all defined goals and the realization of national interests.

The most widespread in world practice is the policy of free trade and protec-tionism. **The policy of free trade** provides for the removal and reduction of any rest-richons on foreign economic activity, free access of experts to national markets of capital, labor, goods, etc. **The structure of resources and the level of technology of the states are different,** so they can produce goods with different levels of costs. The operation of the principle of comparative advantage forces a country to produce only those goods whose production costs are lower than other countries. **Free trade**

stimulates competition, which contributes to the economic development of the state as a whole, forces national enterprises to improve the quality of their products and lover prices. **Protectionism** is a type of state policy aimed at protecting the domestic market from foreign competition through a system of certain restrictions, the theoretics and practitioners of which were mercantilists T. Man, A. Monctetien and U. Stafford [35 – 37], who justified intervention in foreign trade to project domestic industry from foreign competition. However, under conditions, export-import is not regulated by the state, but by the market situation, so the classifications of the influence of foreign trade of Ukraine on the domestic practice of tariff and non-tariff methods of regulating the foreign economic activity of enterprises **has significant theoretical and practical significance** [1; 3 – 4; 11].

Problem formulation and its connection with important scientific and practical tasks. The introduction of *a free trade zone between them* [40] was not the first significant step of the European Union [39; 41] in relation to Ukraine, *and later on* – on February 28, 2020, our state submitted an application for full membership in it. Before that, in full compliance with the Law of Ukraine dated July 01, 2010 «On the Principles of Internal and Foreign Policy» [4], *the political part* of the Association Agreement between them was signed on March 21, 2014 [46], and *its economic component* was signed on June 27, which is currently being implemented on on the basis of *the Action Plan for its implementation for 2014-2017* approved by the Cabinet of Ministers of Ukraine on September 17, 2014 [11].

Ensuring integration into the European Union is defined as one of the main goals of *the National Security Strategy of Ukraine* approved by the Decree of the President of Ukraine on September 14, 2020 [10], *so the study of the state of implementation of these documents has both theoretical and practical significance.*

Analysis of recent research and publications, the purpose of this article. The issues of Ukraine's trade and economic relations with the European Union are reflected in the legislation of Ukraine, [1 – 12], the works of domestic and foreign scientists, including T. Androsov, V. Bazylevych, L. Batanov, I. Blahun, Yu. Bovtruk, V. Boiko, M. Dzhaman, B. Dodashev, M. Dolishnii A. Yepifanov, P. Ilchuk, A. Kelichavyi, O. Kot, T. Krasnodied, Yu. Krutik, I. Kukharchuk M. Lendiel, O. Lukianchuk, A. Melnyk, N. Mereshko, M. Myronova, M. Minchenko, O. Nikolaichuk, O. Pechenka, Yu. Poliakov, D.Pryjmachenko, O. Stecenko, Yu. Stoliar, V. Khoma, V. Khromov, I. Chychkalo-Kodratska,O. Shajda, K. Shamanska, T. Shtal [13 – 33], I. Vallerstain, T. Man, A. Monkreien, V. Staffort [34 – 37], in electronic [38 – 52] and a number of other sources. However, in their studies in this direction, the issue of the influence of foreign trade on the regulation of foreign economic activity of enterprises is mostly not considered, *which became the defining goal of this scientific investigation.*

Summary of main results and their justification. Despite the unfavorable economic circumstances, the product structure of Ukraine's exports to the European Union has remained stable in recent years. About a third of it is occupied by products of agriculture and food industry, in second place - ferrous metals and products from

them, in third place-electrical and mechanical machines. Regarding various services, in the structure of their export, next to the processing of material resources, information and communication and transport services prevail [33; 48]. In 2020, the share of *EU* states in trade in goods from Ukraine was 40.7 % [33], ***so it avoided such a humiliating status*** *as a raw material appendage of the European Union* and became its full-fledged partner in trade in goods and services, and according to the results of 2022, the volume of exports of goods from Ukraine to of the European Union increased by 4.2 % compared to 2021, amounting to 28.0 billion US dollars [49].

It should be noted that the policy of protectionism in the presence of imperfect competition in the world market is justified [23]. It makes it possible to reduce the negative impact on the national economy of the trends that have developed on the world market; to protect those developing national branches of the economy from foreign competition; contributes to the growth of population employment; increases income to various budgets. There is also an opinion that protectionism is useful in order to protect a new industry, since some industries will not be able to reduce production costs without the elimination of competition from foreign competitors by the state. At the same time, by creating obstacles in international trade, it can lead to stagnant phenomena in the economy, reduce its efficiency and competitiveness. If protectionist barriers are high, trading partners may apply the same measures, and therefore the effectiveness of protectionist policies may be zero. The result of economic contradictions between states due to ill-conceived policies of protectionism can become a trade war. *At the same time, the extremely negative consequences of protectionism* policy are: a burden on consumers; the implementation of significant costs to save jobs in industries that are supported; loss of jobs in sectors of the economy facing foreign competition; decrease in the efficiency of the national economy as a result of not taking this into account in the world economy [3; 32; 34], ***and this actualizes the study of such versatile processes in this direction.***

The following types of state regulation of international trade are distinguishead: *unilateral*, which consists in the application of methods of influence by the governments of countries unilaterally without agreement or consultation with partners. Such measures are mostly taken during the exacerbation of political relations; *bilateral* – involves effective trade policy measures previously agreed upon by trading partner states. Each of the parties warns its partner about the use of any measures, which, as a rule, do not make significant changes in trade relations, but only contribute to them; multilateral agreement and regulation of trade policy by multirateal agreements [2]. ***Levels of regulation of international trade:*** *corporate* - an agreement between companies on the distribution of sales markets, materials, raw materials, spheres of influence, goods and price policy; *national* - foreign trade of the state is carried out in accordance with the national legal framework for the regulation of foreign econo- mic activity; *international* – manifested in the conclusi-on of agreements between states or their groups; *supranational* – the strategy of the world community or mea-sures to regulate international trade through the creation of international special institutional structures and agreements (world trade organizations – General Agreement on Tariffs and Trade (GATT)/World Trade Organiza-

tion (WTO) and the International Chamber of Commerce (ICC) [50].

The main goals of foreign trade regulation: restriction of imports (and sometimes exports). The possibility of achieving this goal depends to a large extent on the elasticity of demand for imports in the domestic market. The more elastic the demand, the greater the chance that the restrictions will lead to a reduction in imports; *fiscal goals* – increasing state budget revenues. By its nature, this goal can be considered long-term in the conditions of a dynamic economy. The possibility of its achievement also depends on the nature of the demand for imported goods: the less elastic the demand, the more the state budget will be replenished; prevention of «unfair competition». This term refers to the violation of generally accepted norms and rules of competitive struggle: the use of confidential information and the disseminations of unreliable information; dumping (sale of goods on the foreign market at a price lower than on the domestic market of the country and the exporter), concealment of information important for consumption, etc. [13; 27; 30].

Classification of foreign economic activity regulation methods. Types of duty and their rates. Dependence of customs tariffs on the customs value of goods. *The methods* (*tools*) *of foreign trade policy are very diverse* – there are more than a thousand of them. This determines the existence of different approaches to their classification. In particular, some scientists present ***the following classification of instruments for regulating international trade in goods:*** 1) according to the nature and goals of the application of regulatory measures, the following instruments are used: which provide for the use of regulatory methods for the crossing of the customs border by goods (border measures); that require the application of approaches that apply to the domestic market as a whole, but do not affect the conditions for access of foreign goods to the domestic market; used to improve access conditi-ons for domestic goods to foreign markets, including retaliatory measures that do not aim to restrict access to markets, but are a means of pressuring partners to remove their restrictions, which can take various forms; 2) by type of instruments used: ta-riff – duties and other customs and tariff measures; non-tariff – the rest of the regula-tory instruments; 3) by the nature of the influence of competition limiting foreign competition in the domestic market; ensuring fair competition, which leads to an increase in the competitiveness of own (national) goods on international markets; aimed at eliminating restrictions on competition in foreign markets and facilitating the access of goods to the national market; 4) depending on the specifics of the application of regulatory measures: unilateral (autonomous) - use by state goverment unilaterally without agreement or consultation with trading partners, which are used mostly during aggravation of political relations [12]; bilateral – within the framework of bilateral agreements previously agreed by trading partner states. Each of them warns its trading partner about the use of measures, which, as a rule, do not make significant changes to proper trade relations, but contribute to them; multilateral applied only within the framework of multilateral agreements (for example, GATT/WTO); 5) *from the point of view of the historical development* of protectionism forms and the evolution of international trade: the tools of historical protectionism are mainly of a clearly defined restrictive nature and manifest themselves in the

creation of fairly significant trade barriers that prevent the access of various foreig goods to the domestic market in general [3; 12– 15; 18– 24].

The goal of traditional protectionism is to transform the conditions of competition in such a way as to enable national enterprises to compete successfully with foreign suppliers for the set of competitive advantages and the supply of factors of production that national enterprises have. This goal is achieved due to interference in the market competitive environment and a certain decrease in the efficiency of the use of resources in the economy, and at the same time, conditions are created for the functioning of enterprises that are less efficient from the point of view of the world market. Thus, in a certain sense, the entire economy adapts to inefficient enterprises or sectors of the economy. This form of protectionism discriminates against foreign goods. Its important feature is its relatively passive nature. This is evident in the fact that the state primarily seeks to preserve the position of national producers in the domestic market. The application of measures of such protectionism is subjective in nature: it is not always possible to track their relationship with objective economic indicators. The most typical examples of the use of tools of this form are border barriers in the form of tariff and non-tariff restrictions on trade in goods: tools of selective protectionism, mostly directed against unscrupulous and, at best, dange-rous foreign competitors. *Within the framework of this concept of protectionism*, there are two directions: *the main one* is countering unfair competition; *supplemen-tary –* extraordinary restrictive measures that are applied in case of a threatening exacerbation of foreign competition [20]. In its pure form, *such protectionism* is not so restrictive as it is corrective in nature and is aimed at eliminating distortions of normal conditions of competition that may arise in connection with state intervention (in the form of *subsidies*) or with the discriminatory policy of private companies in the sphere of prices (*dumping*). At the same time, theoretically, conditions are not created for limiting international trade as a whole, but it is possible to use competitive advantages and the advantages of the international division of labor - restrictions are not a means of discrimination, but, on the contrary, eliminate it. The peculiarity of this type of protectionism lies in the fact that it cannot be limited to border measu-res – trade policy goes beyond the actual measures of export and import regulation.

An effective policy in the field of trade in goods becomes possible only in combination with appropriate measures in the field of capital movement, trade in intellectual property objects. In such trade, the measures of selective protectionism are applied in the form of a special procedure of a quasi-judicial nature, which precede the application of border restrictions in the form of measures of tariff and less often quantitative restrictions (*antidumping, compensatory and protective me-asures*): instruments of global (*extraterritorial*) protectionism – affect the conditions of production abroad. The state implementing such a policy tries to influence the conditions of use by competitors of advantages and factors of production in competing countries. *Trade restrictions* are applied in cases where the structure of the use of factors of production in competing countries is such that, according to one or another parameter, they can receive comparative advantages for reducing costs (for example, the absence of economic requirements or a system for ensuring the social

rights of employees in the country). This approach is aimed at forming unified standards of economic development from the standpoint of forming competitive advantages in international trade. Its manifestation, among other things, is the concept of «fair trade». For example, the goal of application is declared to be the desire to eliminate deviations from generally accepted social and economic standards, the use of the provisions of the well-known articles of American legislation 301 and 301-super. This concept is mainly applied by states with a high level of economic development and appropriate economic, social and technical standards and foresees the possibility of creating obstacles in international trade, and in the worst case scenario, in the formation of relatively closed groups of countries with more or less the same level of economic development. However, the concept of extraterritorial protectionism is not compatible with the development of multilateralism in the regulation of international trade. The form of implementation is trade and political negotiations, in case of failure of which restrictive measures may be used [19; 26]. Simultaneous-ly, all these three systems of protectionism follow each other in historical develop-ment, but from the point of view of their application, they can often be used at the same time. At the same time, the classification of instruments of state regulation of foreign trade by their nature into tariff and non-tariff instruments, which are reflected in various legal documents of national and international law, has become the most widely used. It was first proposed by the GATT Secretariat [50] in the late 60s. *The first group* (*tariff instruments*) exclusively includes duties, which are fixed in the form of a customs tariff (*export and import*) as the most common traditional means of foreign trade policy. *The second* (*non-tariff*) - the rest of the instruments [17].

Types and rates of customs duties. Duty rates. Dependence of customs tariffs on the customs value of goods. The means of trade and political struggle of any state establish the regime of its foreign trade or agreements with the governments of other countries, and the most influential type of trade restrictions is *customs duty* – a tax levied on goods when they cross the national customs border. *An import duty* is a tax levied on imported goods, while *an export duty* is levied on exported goods. Most countries apply only import duties, and export duties are mainly used by developing countries in relation to traditional exports in order to obtain better prices and increase revenue (for example, the export of coffee from Brazil or cocoa from Ghana). On the other hand, import duties are imposed to protect certain sectors of the economy. At the same time, *the duty* may be imposed on the value and quantity of the goods. *Ad valorem duty* is applied as a percentage of the value of the goods as a subject of trade. *Specific* - set as a fixed amount of funds for the physical volume of the product. *Combined* – involves the establishment of an ad valorem and a specific duty at the same time [7 – 8; 14; 17].

In 1953, certain industrialized states signed *the Convention on the Unification of Methods for Determining the Customs Value of Goods* [6], according to which *the ad valorem duty* is charged from the so-called normal price of the goods, which exists at the time of filing the customs declaration and includes all the costs of delivering the goods to the border. Along with this, the duty can be *autonomous or*

conventional. The autonomous duty is established by the decision of the state autho-rities of the respective country, regardless of any agreements with other states. *Con-ventional*– assumed in the process of concluding an agreement or contract with another country and fixed in them. It can-not be changed during the entire term of its validity. These goods are grouped into separate groups based on their origin (in-dustrial, vegetable, animal) and the degree of their processing. Opposite each of them is indicated the corresponding amount of duty that it is subject to. The classifi-cation developed by the UN is used to group commodity items [52]. Customs tariffs include simple (*single-column*) and complex (*multi-column*). Simple customs tariffs provide for *one duty rate* for each product, regardless of its origin. *A complex cus-toms tariff* involves two or more duty rates for each of the goods. The highest rate is called *maximum*. It is used for the goods of those countries with which there are no agreements. The lowest, *minimum* rate is usually applied to the goods of those count-ries with which trade agreements are signed [7 – 8].

Thus, with the use of the duty, income is redistributed from consumers, who are forced to pay sometimes much more, to producers of this product in the state, which can get a higher price for their product, increase the profitability of that factor, which is considered relatively rare in the country and is used for production of im-port-substituting products, reducing the profitability of that factor, which the state has in large quantities, using it for the production of export goods. Such trends usual-ly lead to a decrease in the overall efficiency of the economy and are the price to be paid for the introduction of the tariff. Such trends usually lead to a decrease in the overall efficiency of the economy and are the price to be paid for the introduction of the tariff. If we divide the costs of the economy by the number of saved workplaces, we get the value of one workplace. At the same time, quite often the country does not set customs duties on the import of raw materials or components, which are requ-ired for the creation of final products on the territory of this country, and the main reason for this is an attempt to encourage local production and create workplaces in the country. *And the optimal tariff* is the tariff rate that maximizes the net gain as a result of improving the trade conditions of a certain country against its negative im-pact on the volume of trade (i.e., reducing its volume). Thus, after the introduction of a tariff, the total welfare of the state increases until the value of the tariff rate reaches its optimum, and then, if the corresponding rates continue to rise and the welfare gradually decreases [3; 7; 21; 44].

Licenses and quotas in foreign economic activity. Hidden methods of trade policy. Dumping and forms of combating it. Despite the fact that historically the tariff is an exceptionally influential method of trade restrictions, there are a large number of other administrative restrictions – *anti-dumping regulation, import quo-tas, etc.* A very important type of non-tariff restrictions is a quota, which is a direct quantitative limit on the volume of goods that are exported or imported. *Import quotas* can be used to protect national industry, agriculture or to balance the balance of payments and trade [5; 8; 14; 27]. One of the important methods of non-tariff restrictions is *voluntary restriction of exports*, which is understood as the situation

when the state forces another country – its trading partner to «voluntarily» limit the volume of exports under the pressu-re of applying stricter trade restrictions, if it threatens the activity of the industry of the importing country. *Quoting* (contingen-tings is a restriction by the state authorities of the import of goods to a certain amount or amount for a set period of time. Otherwise, the government sets a general (*global*) quota that can be used by all countries. Under the licensing system, the free export of certain goods is prohibited. *A license* is a permit that gives the importer the right to import a certain amount of goods into the state. They are issued by government bodies to the largest importers of goods. At the same time, *individual and general* licenses are used. *An individual* permit is mainly a one-time permit for the import of the corresponding product, valid for a limited period of time. *The general* list is a list of goods that are allowed to be imported freely during the time specified in it. At the same time, *the general license* must be published in the official publications of the country. Along with direct restructions developed countries also use a compre-hensive system of *indirect protectionism* measures. This includes various customs formalities, sanitary-veterinary regulations and the system of internal taxes and fees and various administrative rules directly related to the use of foreign goods, and a number of other rather important provisions [7; 14; 17; 21 – 22].

Trade and political means of expanding the export of goods. *Today, there are two main directions:* 1) export crediting for the purpose of expanding the sale of goods; 2) sale of goods for export at prices that are lower than world (*dumping*) prices. *Export subsiding* is a form of government policy that makes it possible to sell domestically produced goods on the foreign market at the lowest possible prices. One of the trade and political means of expanding exports is export premiums, which can be applied in direct or indirect forms. *Direct export premiums* are implemented by the exporter providing one-time subsidies for the export of goods. *Tax benefits* are also used – they are indirect export premiums, when exporters are given financi-al benefits. One of their forms is a system of duty exemption or refund for companies using imported raw materials for the production of export goods (for duty-free import and duty refund). At the same time, we note that trade agreements belong to important means of trade policy, defining the legal conditions on which economic relations between governments and individuals and legal entities of the country that signed them are based [25].

Customs-tariff system of Ukraine. The effectiveness of any organizational system depends on the quality of performance of those functional tasks facing it, that is, how effectively this system works in regulating market processes. Orientation to the market model of management required a fundamental change of the entire natio-nal economic system. Meantime, *integration into the global economic space* is beco-ming one of the main foundations of the new economic policy. Abolition of the main principle of building foreign economic policy under the centrally planned system - the monopoly of the state on foreign economic activity - necessitated the creation of a new system of regulating relations in the field of international information and analytical work and customs statistics. In accordance with the relevant regulatory and legal documents, the regulation of customs matters is carried out by the highest

authorities and administrations of Ukraine: the President of Ukraine; the Verkhovna Rada of Ukraine and the Cabinet of Ministers of Ukraine [1; 7; 14]. Concomitantly with it, during the evolution of the customs system of Ukraine [9], the regulation carried out by the customs authorities has also undergon significant changes. In its first stages, the prerogative was given to the legislative and executive powers, and in the following ones, the direct management of the State Customs Service of Ukrai-ne is carried out by the President of Ukraine. At the same time, the use of such an effective tool for regulating international economic relations as the customs system requires the formation of a very lean and efficient management vertical to realize primarily state interests. The presence of contradictions in the regulation of the customs system between different branches of government leads to the corresponding collision not only in theory, but also in practice. The subordination of customs bodies to a certain state institution depends on the domi-nance of certain functional tasks that are solved by this body in the system of foreign economic policy. There are countries where customs bodies are subordinated directly to the ministers of foreign trade, foreign economic relations or economy, but most countries have included them in the structure of the Ministry of Finance. The main argument for such subor-dination is the need to control financial flows by this state structure. Therefore, fiscal bodies are subordinated to financial control bodies. The State Customs Service of Ukraine (until 1996 – the State Customs Committee of Ukraine) is *the specially aut-horized central body of the executive power in the field of customs matters*, which coordinates, controls and directs the activities of customs authorities for the proper implementation of national legislation on customs matters and, within the limits of its authority, issues appropriate orders or instructi-ons, organizes and monitors their execution. And, since the customs bodies are state bodies for the regulation of fore-ign economic activity, their financing takes place at the expense of funds allocated from the State Budget of Ukraine [9; 31; 42].

Customs and tariff regulation of foreign economic relations in Ukraine is carried out by customs authorities within its territory. The territory of Ukraine, including structures, installations, artificial islands created in the economic (sea) zone, over which Ukraine has exclusive jurisdiction in customs matters, constitutes *a single customs territory*. The regulation of these relations covers various types of customs territories: *the national state customs territory* is the territory of a state that includes land, territorial sea, internal waters and air space and artificial islands, installations and structures that are created in the exclusive maritime economic zone over which the jurisdiction extends the relevant state; *a united customs territory* created by states as a customs union; *the territory of free customs zones*; *customs territory of economic zones; the territory of free customs zones*, etc [7].

The border of the customs territory of Ukraine is its customs border. At the same time, the customs border coincides with the state border, with the exception of the borders of the territories of free customs zones and free customs warehouses, which is the actual customs border of Ukraine, which is 7,190 kilometers long. There are 65 customs offices and 260 customs posts of territorial administrations operating on the territory of Ukraine. The border with Russia is 2,063 km; with Moldova –

1191; Belarus – 975; Romania – 625; Poland – 543; Hungary – 135; Slovakia – 98 kilometers. A number of customs points are located at the customs border, where actual customs control over the import and export of goods, currency, currency values and international postal items is carried out and *various customs operations are provided*. In some cases, state territories can be removed from the customs territory, for example, due to the functioning of free economic zones, or vice versa, included in the borders of the customs territory (for the creation of customs unions).

The customs border within the international integration economic associations in the system of states is determined by them, based on national law and international treaties and agreements. Within the territorial scope of the customs services of individual legal systems, for example, in the European Union zone, these zones are demarcated into customs districts, in which the relevant general and specific powers of the relevant customs services in their states are exercised [8; 50].

The time of functioning of the customs system of Ukraine can be divided into two periods. *The first* is determined by the period from 1991 to 1996, *the second* from 1997 to the present, *when the main task was* the formation of the customs sys-tem of Ukraine as a whole. At the same time, the formation of the customs system was associated with specific economic, political, social phenomena and prerequisites for its functioning, determined by the process of creation of Ukrainian statehood, the transformation of the economic system, and the nature of foreign economic activity. This stage is characterized by the conceptual justification of the role of the customs system in the foreign economic system of Ukraine, the legislative development of customs policy issues and the concrete implementation of such legal norms in practice, taking into account the specifics of the customs system and its functioning in the conditions of a change in the economic paradigm. Until 1992, the customs tariff system included 26 customs offices (which employed about 2,500 people), directly subordinated to the Union authorities. In 1992, the structure of the system already had 65 customs offices, which were subordinate to the Customs Committee of Ukraine. By 1995, the legal framework for the regulation of customs-tariff relations was created and the organizational structure of the customs system was practically developed, which included 8 territorial administrations, 79 customs offices, and 243 customs posts (about 20,000 people).

The main tasks of the second stage were: unification of national customs legislation with international legal norms; working out the mechanism of customs taxation, customs control and customs clearance; reforming the organizational structure of the customs system to increase the number of subjects of foreign economic activity and increase their activity on the foreign market led to the need to improve the structure of the customs system. Since 1996, the management scheme of customs authorities has been fundamentally changed – their territorial administrations have been eliminated and the number of customs offices has been reduced. Regional customs combined the respective functions of operational and coordinating bodies in the region. At the beginning of 2000, the structure of the customs system of Ukraine consisted of the central apparatus, 10 regional customs offices, 46 customs offices,

187 customs posts, 12 specialized cus-toms institutions and organizations. About 19,000 customs officers provide customs control at 74 automobile, 36 aviation, 40 sea and river, and 4 ferry checkpoints, thro-ugh which 160,000 – 180,000 citizens and about 40,000 units of various types of transport cross the customs border every day. At the same time, the system of cus-toms authorities of Ukraine does not remain stable, but is in a constant state of dynamics, because according to the results of its activities, it is being reformed in accordance with the modern industrial and transport infrastructure of Ukraine and the volume of goods flows [7 – 8; 31].

That is, the customs system of Ukraine is a single general system, which includes customs authorities and specialized customs institutions and organizations. *In turn, the basis of the customs bodies is*: the Central Office of the State Customs Service of Ukraine; regional customs; customs; customs posts. ***Nevertheless, the system of customs authorities is divided into two levels*** [8]: *to the first of them* includes the State Customs Service of Ukraine, which operates throughout the territory of Ukraine; *to the second* – all other customs authorities that operate on the territory of the subordinate region. The central apparatus provides general management of the customs system of Ukraine in accordance with the legislation. It directs, coordinates and controls the activities of customs bodies and specialized customs institutions and organizations in relation to the legislation of Ukraine on customs matters. Regional customs offices perform the role of regional customs authorities, carrying out comprehensive control over compliance with customs legislation within the limits of their competence in the territory of the region assigned to them, while providing guidance and coordination of the customs office. Although the regional customs is a component of the unified system of the State Customs Service of Ukraine, it is an independent legal entity [8 – 9; 31; 43].

Customs is a state body that protects the economic interests of Ukraine and ensures the implementation of legislation on customs issues, the collection of duties and customs fees and other customs payments, and is an independent legal entity that carries out its activities within the region (territory) determined by the regional customs in agreement with the State Customs Service of Ukraine. The creation, reorgation and liquidation of customs offices is carried out by the State Customs Service of Ukraine, and the structure, maximum number and salary fund of customs employees is approved by the head of the State Customs Service of Ukraine at the request of the regional customs office. The customs office is subordinated to the regional customs office, but in some cases - directly to the State Customs Service of Ukraine. In order to ensure the performance of functional tasks by regional customs and customs offices, customs posts are mostly created under the authority of its structural subdivision at checkpoints across the customs border of Ukraine or other objects with a significant volume of foreign economic transactions. At the same time, a cus-toms post is a customs unit that directly carries out customs control and registration of vehicles and goods moving across the customs border. Customs posts are created as necessary, taking into account the administrative-territorial division, geographical location of the district at railway stations, airports and highways, sea and river ports. Their creation, regionalization and liquidation is carried out by the State Customs

Service of Ukraine at the request of the regional customs [8 – 9; 47].

Customs laboratories play a special role in customs regulation. Considering the fact that the number of subjects of foreign economic activity and, accordingly, the volume of foreign trade operations is increasing, conflicting situations arise bet-ween customs authorities and business subjects, especially with regard to customs taxation. The solution of such problems, among which the determination of the cus-toms value or the classification of goods according to the commodity nomenclature of foreign economic activity has a special place, is possible only with a qualified examination of the goods being moved, which will take place only with the creation of an extensive system of these laboratories [16]. Therefore, depending on the terri-torial location, customs offices and customs posts are divided into **border** (*external*) and **internal**. This is related both to the routes of movement of goods together with passengers, and to the place of concentration of subjects of foreign economic activi-ty. *Border offices include* customs offices or their subdivisions, which are located: a) on the customs border that coincides with the state border, at checkpoints on the state border through which rail, road, sea, river, wind and other connections are carried out and in other areas of the customs territory of Ukraine; b) at points located on the customs border where it coincides with the limits of special customs zones on their territory. They mainly record the passage of goods across the border and inform the internal customs about this and carry out customs control of passenger traffic.

The internal ones include customs offices and their subdivisions, located in places of concentration of subjects of foreign economic activity in the customs territory of the country, which carry out cus-toms clearance of goods and control over their delivery, collection of customs payments and other customs procedures directly on the spot. The specified differentiation in the organization and functioning of customs offices and their divisions has its advantages, but along with it there is a whole series of problems of an organizational and management nature. The functioning of the system of external and internal cus-toms made it possible to relieve tension from customs posts located on the border, to significantly speed up the process of move-ment across the customs border, but there were also problems with the delivery of goods to internal customs, the application of the customs regime (transit). In the complex of directions and means of solving these problems, the main thing is to improve the organizational and management mechanisms of interaction of customs authorities along the entire route of goods movement. *At the first stage* of the formation of the customs system in Ukraine, the main bodies in it were external customs, *at the second* – internal. *In our opinion,* the current stage of the development of the customs system of Ukraine requires the creation of one more link in the chain – specialized mobile customs gro-ups, **the main purpose of which would be** customs control at the stage of cargo transit between external and internal customs. This would make it possible not only to solve the problems of various violations of customs rules, but also to ensure the effective work of customs authori-ties in the fight against smuggling. For the purpose of effective activity, the State Customs Service of Ukraine may create specialized departments and organizations for the declaration, storage and sale of customs cargo, provision of means of control,

construction and economic services, information and analytical centers, canine services, educational institutions for training and retraining of personnel and consulting-information points, etc [14; 31].

The evolution of the customs and tariff policy of Ukraine since the formation of the country has passed four such stages: the first (1991 – 1993 years): was characterized by a change in priorities, when the main thing was control over foreign trade activities, and not over the movement of individuals, as was the case under the centrally planned system. A fairly strict export and liberal import regime was implemented, i.e., the preferential function dominated in relation to imports, while the export duty had its own fiscal orientation, which was associated with a number of problems, but the main one was the lack of a general concept of transforming the economic system from a command-administrative model to the market. The dominant reasons for applying import liberalization were: firstly, saturation of the state's consumer market in conditions of its imbalance; secondly, the relatively broad pressure of international financial and economic organizations, which are always interested in liberalization, especially of imports; thirdly, the competitive factor, the hope that foreign-made products will force national manufacturers to increase the efficiency of their production [14 – 15; 42]. In Ukraine, until the beginning of 1993, the Customs Tariff of the USSR formally applied to goods imported into its territory, *which had the following feature*: equipment, raw materials and equipment were not subject to import duties, while food products and consumer goods were subject to customs duties. The unified customs tariff of Ukraine from January 11, 1993 provided for rates from 0 to 10.0% in most of its tariff items.

A small part of the goods was subject to higher rates – 15.0 – 30.0 %, and the maximum level of duty was provided for alcohol and tobacco products – 50.0 % for goods from the countries that used the most favored nation regime, used tariffs that amounted to 2.0 – 5.0 % . The positive effect of the liberalization policy in relation to imports was the reduction of the imbalance between supply and demand in the domestic market, but a negative trend was observed of the unwillingness of most national enterprises to compete with foreign ones. This manifested itself in the complicated sale of pro-ducts, the loss of sales markets, in particular, the domestic one, the decline in production, etc. Disproportions between domestic and world prices became the main important reason for choosing a tough customs and tariff policy for exports. *The administrative regulation of prices* led to their preservation at a much lower level compared to world prices, which stimulated the export of goods from Ukraine and exacerbated deficit problems. At the same time, the filling of the state budget from foreign exchange revenue and export duty led to the inclusion of almost the majority of potential exports under the effect of export duty or non-tariff regulation methods.

The implementation of this system of export regulation was undoubtedly expedient, but the functioning of the mechanism for distributing permits, quotas, and licenses for the export of goods turned out to be relatively ineffective. The creation of a complex procedure for obtaining the right to export goods not only laid the foundations for the shadowing of the Ukrainian economy, but also eliminated the

beginnings of a competitive environment, without which the functioning of the market as an economic system is impossible, since the ratio between prices was in favor of world prices, and there was a reorientation of export supplies from the CIS market to various western markets [26].

The second stage (1994 – 1995 years) – its main purpose is fiscal, that is, filling the state budget due to taxation of imports and exports. In connection with the liberalization of the foreign trade regime, a mechanism of tariff regulation is being created, aimed at obtaining tax revenues, i.e. ensuring, first of all, a purely fiscal function, and then – at the protection of the national producer of goods. This was manifested in the increase of the average duty rates to 20.0 % at the preferential rates and to 30.0 % at the full rates, in the cancellation of the preferential duty for importing products from the CIS countries and the increase of the maximum rates to 300.0 – 350.0 % (alcoholic beverages). In connection with the fact that the import duty rates were mainly increased on consumer goods, a small number of goods were subject to the customs tariff, the average weighted amount of the duty was 11.9 %, and for the countries with which Ukraine concluded agreements on free trade tra-de – 6.3 %. However, we note that the degree of actual protection of certain goods was definitely increased by high rates of excise duty on imported products. At the same time, the foundations for a coordinated customs and tariff policy were laid - this is the creation of *the Customs and Tariff Council under the Cabinet of Ministers of Ukraine* in 1994 and the adoption of the first resolution on changing import duty rates, which was more fiscal in nature, although it had elements of protectionism. The abolition of export taxes during this period practically did not change the situati-on for the better, and the main obstacle in the way of exports was the introduction of the policy of «two exchange rates»: high (*official*) and low (*market*). Establishing for exporters the mandatory sale of half of their foreign exchange earnings at the official exchange rate made the export of goods unprofitable.

Along with this, it should be noted that in 1993 – 1996 there was a rather positive deformation in the field of foreign economic relations. This was manifested first of all in the growth of foreign trade volumes, as evidenced by the data on the dynamics of export-import transactions during the relevant time. Under the influence of the liberal customs and tariff policy, the foreign trade turnover of Ukraine steadily grew during the years 1993 – 1996 by an average of 17.3 % annually and in 1996 reached the highest le-vel - 38.0 billion US dollars. Another positive and important trend for the economy of Ukraine was observed: the outpacing growth rates of exports of goods and services over their imports. Thus, during 1993-1996, the average annual growth rate of exports was 20.7% (2.75 billion US dollars), while the average annual growth rate of imports was only 14.1% (2.05 billion US dollars). Therefore, the volume of exports grew annually by 6.7% or 0.70 billion US dollars more than the volume of imports. This development of events gave Ukraine an extremely important opportunity in 1996 to achieve a positive trade balance of 249.2 million US dollars for the first time during the years of independence. [33; 48].

The third stage (1996 – 1999 роки) it can logically be characterized as protec-

tions, *the main purpose of which* is to protect national producers of goods from foreign competition. During this period, there was a tendency to increase import duty rates, the application of a combined duty, preferential rates were practically equalized with full rates, a minimum customs value was established, and a preliminary rate of import duty was introduced. All such measures, and especially tax clearance at the border, therefore, until the moment of actual sale of goods, put imported goods in unequal conditions compared to domestically produced goods. Fiscal revenues from customs duties were mainly due to the increase in import rates for foreign products profitable on the Ukrainian market (highly liquid, excise duty), taking into account the measures related to the determination of the customs value, tariff position and the countries of origin of the goods. The supply of raw materials for domestic enterprises was taxed at minimum customs rates. **An export tax** (*export duty*) was introduced on the export of certain types of products. The strengthening of protectionism in the customs and tariff policy was combined with measures to bring this system to the requirements of the GATT/WTO in connection with the negotiation process regarding Ukraine's accession to these international organizati-ons. This led to the fact that the priority in the regulation of export-import operations was given to administrative and technical measures, and the weighted average rate of import duty was reduced to 6.0 %. At the same time, the base of customs taxation was significantly expanded due to the elimination of benefits granted to certain subjects of foreign economic activity, which significantly affected the effectiveness of customs policy. Thus, in 1995, 74.0 % of alcoholic beverages and 98.0% of to-bacon products were imported without payment of taxes by state and commercial entities that enjoyed benefits from customs taxation of imported goods. And during January-August 1996, about 80.0 % of all imports were made with the declaration of certain tax benefits [7 – 8; 42; 48 – 49].

In November 1996, amendments were made to Article 2 of the Decree of the Cabinet of Ministers of Ukraine of January 11, 1993 «On the Unified Customs Tariff of Ukraine», which provided for its right to change the duty rates only in relation to the objects of customs taxation and it was forbidden to reduce the duty rates for individual legal entities and individuals and under specific foreign economic contracts, or to exempt them from payment of customs duties or postpone the terms of their payment. Laws entered into force in 1997, according to which all types of benefits granted to legal entities and individuals for the import of almost all excisable and most non-excise goods and benefits for receiving humanitarian and technical assistance by organizations in the form of goods imported into Ukraine were canceled. The strengthening of the protectionist orientation of the customs and tariff policy of Ukraine, especially in relation to imports, quickly affected the volume of foreign trade operations. So, if in 1997 the decrease in foreign trade turnover compared to the previous year was 1.0 %, and in 1998 it was already 13.2 %. In 1996, foreign trade turnover decreased by 14.1 % (by 5.34 billion US dollars). During the same period, Ukraine was able to maintain an additional trade balance only due to the fact that imports of goods and services decreased faster than exports. Thus, the average annual rate of import reduction was 7.5 %, and the corresponding indicator for ex-ports was

only 7.1 %, imports decreased annually by 0.4%, or by 51.0 million US dollars more than the volume of exports [7 – 8; 23; 31; 49].

It is also worth noting that the analysis of the above indicators indicates an increase in customs duty rates, which leads to a decrease in the volume of foreign trade, and their decrease, in turn, leads to an increase in its volume. Thus, there is a very strong negative correlation between the level of protectionism and the volume of foreign trade turnover. However, *the customs and tariff policy* is not the only factor that affects foreign trade and determines the corresponding dynamics of Uk-raines foreign trade turnover. It is worth noting that a number of external and internal factors contributed to the development of negative trends. *The main external factors are* the aggravation of the world financial crisis and, as a result, the reduction of world trade and the deterioration of the conditions of the main commodity markets for traditional Ukrainian exports. *The internal factors of negative impact on foreign trade turnover were*: decline in production, strengthening of the payment crisis and difficult financial condition of enterprises, high cost of domestic products due to their low quality and instability of the hryvnia. Therefore, in this period of time, the extensive development of foreign trade was practically exhausted, therefo-re, the implementation of appropriate structural changes in export-oriented or other branches of production to increase the volume of foreign trade turnover was impossible [15].

The fourth stage (1999 – 2004 years). Improvement of customs and tariff regulation in accordance with the requirements of international legislation. This can be seen in such decisions. First, the legislative framework for joining the Internatio-nal GS Convention was created, while the tariff nomenclature was optimized due to national detailing at the level of 9 and 10 characters of description and coding of goods. Secondly, appropriate predictability was achieved in making decisions on changes in import duty rates. In 1999, by decision of the Customs and Tariff Council, such rates began to be accepted once every six months, and since 2000 – once a year. Thirdly, there was a reduction in rates on a significant range of goods in the textile industry in accordance with Ukraine's obligations to the EU – reduced duty rates on raw materials and increased rates on finished products produced in Ukraine. Characteristically, the growth of the protectionist trend in Ukraine occurs in parallel with the development of shadow foreign trade turnover and smuggling of goods, which leads to mass evasion of customs duties, customs duties, excise and value added tax. The paradox lies primarily in the fact that the increase in import taxes in the form of an increase in customs rates and discriminatory procedures causes the inadequate functioning of the tariff system of Ukraine and leads to insignificant customs revenues to the budgets and, as a result, the protection of the national producer is reduced. Thus, the customs and tariff system in 1995, before the comprehensive increase in customs duties on goods, provided 2.99 % of state budget revenues, in 1996 – 1.53 %, in 1997 – 9.72 %, in 1998 – 10.5 %, in 1999 – 10.72 %, 10. 5% in 2000, and 12.04% in 2001 [20; 22; 31].

In other words, a completely natural result of the evolution of the customs and tariff policy in Ukraine during the decade of independence was the creation of such legislative conditions for the functioning of this system, which were based on gene-

rally accepted international norms and standards and practice. The mechanism for the implementation of the customs and tariff policy was formed. The goal of the next stage was to raise to a qualitatively new, significantly higher level of economic efficiency of the functioning of this important for the state system of coding and classification of goods in foreign economic relations and the method of forming commodity nomenclature of foreign economic activity [3; 8; 28; 52].

The transition to new principles of regulation of foreign economic activity (quota, licensing, tariff regulation, etc.) in accordance with world practice requires changes in the organization of customs control over goods in foreign trade. The effective use of tariff regulation methods depends not only on the system of taxation of goods for movement across the customs border, but also on the application of customs control procedures and their registration. The correct classification of the coding of goods is an important element of the system of customs regulation of foreign economic activity – it depends on the establishment of their value according to objective criteria and, accordingly, the reasonable calculation and collection of customs payments. In addition, the correct classification of goods is of great importance for increasing the objectivity of customs statistics in foreign economic activity, since it is used to develop the optimal customs policy of the state. Modern customs tariffs include tens of thousands of goods. The total number of product items reaches 5 thousand, which include a number of sub-items, which is a consequence of the tendency to increase the number of goods subject to customs tariffs. At the same time, it is important to note that the problem of classification of goods for customs purpo-ses is primarily of an economic nature. By classifying goods into commodity hea-dings, customs authorities can create additional protectionist barriers to imports or, on the contrary, stimulate the flow of goods to the country. Thus, the change in the structural customs tariff (in the direction of strengthening its detailing – the selection of various types of goods into separate product headings and subheadings) provides an opportunity, leaving unchanged or even reducing the average amount of customs taxation by reducing tariff rates, which have lost their trade, political and economic effectiveness, or rates on goods whose import has been suspended, to increase tarif rates on various products of individual sectors of the economy that require a higher level of tariff protection. Therefore, the more fragmented the structure of the customs tariff is, the more effectively it can be used for protectionist purposes, i.e. the basis of the introduction of the commodity nomenclature of the customs tariff is economic relations, and not procedural issues of customs control. **The concept of nomenclature** (*Latin Nomenclatyra – list*) is understood as a system (combination) of names, names, terms used in social relationships, therefore, it is a system of abstract and conventional symbols, which should create the appropriate maximum convenience from a practical point of view for characterizing objects [29].

Commodity nomenclature is a set of names of goods with which customs services and subjects of foreign economic activity work in their professional activities. At the same time, it is necessary to emphasize the concept of «commodity», because the term «commodity» is one of the concepts in the system of customs regulation of foreign economic activity. This is explained by the fact that the goods are the subject

of a foreign trade transaction, which is registered by the customs authorities. If earlier the regime and procedure for the passage of goods were determined based on what is the subject of a foreign trade agreement, now the main criterion is the object of the agreement, that is, a specific product. This led to the development of the com-modity nomenclature of foreign economic activity (CN FEA) [29; 52].

Goods usually mean any products moved across the customs border, inclu-ding those covered by intellectual property rights, services, works that are the object of purchase, sale and exchange. Such a definition includes essential characteristic features of the transported goods, hence its physical form and transportability. These qualities are reflected in its definition as one of the main criteria used in the Customs Code of Ukraine [8]. Since the product is the basis of a foreign trade transaction, the entire set of relations in the field of customs taxation is realized mainly through this economic category [51]. Such interdependence can be traced on the example of the concept of «customs payments», *in which the definition of «goods» is absent*. At the same time, in the mechanism of customs regulation, all customs payments are related to the movement of goods across the customs border either directly (due to the taxation of foreign trade operations for the movement of goods with customs payments – customs duties and customs fees, excise, value added tax) or indirectly (due to the charging of customs duties payments related to the granting of licenses by the customs authorities for carrying out customs brokerage operations, customs declaration by the owner of the customs licensed warehouse, duty-free shop) [7 – 8].

This connection exists not only on the micro level, but also on the macro level. Thus, the trade balance is considered as operations related to the trade of goods, regardless of the form of implementation – barter, export, import, etc. Therefore, in order to conduct research on the product, it is necessary to systematize it – to include it in a complete set, the elements of which are divided into subsets in the form of sections, groups and positions. Accordingly, the classification of goods is one of the main directions of customs regulation of goods flows between countries [28; 42].

Depending on the tasks, the product classification system can be grouped ac-cording to the following criteria: industries, materials, degree of processing, or func-tional characteristics, etc. At the same time, in accordance with the accepted classifi-cations system, all product sections and groups and subgroups received special codes. After their set is divided into subsets in accordance with the chosen classifica-tion system and brought to the system, it can be considered as a classifier of properly systematized objects [28 – 29; 45].

Thus, a classifier is a systematized list of objects that allows them to find their place and proper numerical designation, therefore, which consists of letters, num-bers, or letter-number combinations. In the system of customs regulation of interna-tional economic relations, *the concept of commodity nomenclature is more common*, which in its essence coincides with the term «classifier of goods». *The commodity nomenclature* is understood as a detailed list of goods, which are distributed accor-ding to *the code system of the classification of goods*, created so that the information provided to the customs authority has a convenient form for its collection, verifica-

tion, transfer, processing, issuance and for the purpose of econo-mic analysis [28]. In the process of working with information provided on electronic media (for ex-sample, the electronic version of the cargo customs declaration), the code system of classicization data provides the possibility of processing the information array using computer technology. Thus, the classification of goods using the product nomenclature allows [29]: to code various goods; to carry out customs economic operations (calculation of customs payments and determination of customs value, provision of reporting, planning of the work of customs authoriti-es, etc.); to study the comodity structure in foreign trade, etc.

One of the most important components of the correctness of the classification of goods during customs clearance *is a qualitatively new version of the Ukrainian classification of goods of foreign economic activity* (hereinafter - UCG FEA), which was formed on the basis of a harmonized system of description and coding of goods (on the simplification and harmonization of customs procedures, hereinafter – HS) for implementation the requirements of Article 3 of the International Convention, to which Ukraine joined in accordance with the Law of Ukraine dated October 05, 2006 № 227-V as amended on February 15, 2011 [6; 28]. HS is a multipurpose commodity nomenclature that is used in 207 countries of the world for the purpose of uniform classification of goods. Such a classification is necessary for establishing customs tariffs, carrying out non-tariff regulation and collecting foreign trade statistical data.

In Ukraine, the classification of goods is carried out on the basis of UCG FEA – the commodity nomenclature of the Customs Tariff of Ukraine, which is approved by the Law of Ukraine dated June 04, 2020 No. 674-IX [7] and is built on the basis of the GS of 2012 (5th edition), and the new version of the HS is the 6th edition of the World Customs Organization of 2017 (HS of 2017), entered into force on January 01, 2017. The State Fiscal Service of Ukraine has developed a new version of UCG FEA 2017 as a product nomenclature of the Customs Tariff of Ukraine for 2017 and submitted it to the Ministry of Economic Development for the development of this new version. It contains 256 codes (at the level of 10 characters) more than the 2012 UCG FEA - 10772. In order to ensure its implementation, it is supplemented with transition tables in accordance with the current and new versions of the UCG FEA: direct (UCG FEA 2012 – UCG FEA 2017) and inverse (UCG FEA 2017 – UCG FEA 2012), developed on the basis of correlation of HS tables 2017, EU correlation tables from 2013 to 2017 and the Customs Tariff of Ukraine.

Product nomenclature. Harmonized system of description and coding of goods. Brussels customs nomenclature. UN Standard International Trade Classification. With the rise of foreign trade in the middle of the 19th century. there was a problem of unifying the nomenclature of goods to compare the results of foreign trade with customs prices. At the same time, the First International Statistical Congress of 1853 in Brussels developed recommendations for the unification of commodity nomenclatures of various states with the aim of generalizing statistics in the field of international trade. In 1890, the International Congress on Customs

Regulations, held in Paris, also emphasized the importance of solving the problem of unifying the nomenclature. In particular, most of the countries of the world, summarizing the results of foreign trade in the statistical directories of that time, published the nomenclature of those goods that had the greatest significance for the foreign trade of the state. Meanwhile, some countries classified them alphabetically, while others classified them according to the criterion of origin (industrial and agricultural goods). And 60 years later, the first product range was formed. On December 31, 1913, twenty-nine countries of the world signed the Convention in Brussels that, while preserving national classifications and commodity nomenclatu-re for all their publications, they undertake to compile and transmit to the specially created International Bureau of Foreign Trade Statistics data according to a unified classification and commodity nomenclature. The initiator of this implementation was *the Economic Council of the League of Nations*, which developed the correspon-ding unified product nomenclature. The first product nomenclature consists of five sections, which include 186 basic items: 1. Live animals - seven commodity items (1 – 7). 2. Food and beverages – forty-two product headings (8 – 49). 3. Raw materia-als and semi-finished products – fortynine commodity items (50 – 98). 4. Finished products – eightyfour product items (99 – 182). 5. Gold and silver and unwrought gold and silver coins are four commodity headings (183 – 186) [29; 45; 50].

The insufficient detailing of the nomenclature, and, therefore, the inconveni-ence of using it as a world standard led to the creation of a new product nomenclature called «*Minimum list of goods for world trade statistics*», the feature of which is the classification of goods, which were divided into subsets depending on the type of material from which they were manufactured. Classification of goods according to the principle of their use was envisaged in exceptional cases. Such a product nomenclature of the vertical type was published in 1938. All goods were divided into 17 sections, which in turn were divided into 50 groups and 456 basic product items. From time to time, the minimum list of goods for world trade statistics was supplemented and refined, and in some countries it became the basis of national classifications. By the 1990s, the following three classification systems were the most widely used in the system of customs regulation of international economic re-lations: 1. The unified commodity nomenclature of foreign trade of *the Council for Mutual Economic Assistance* (CMEA) countries-members; 2. UN Standard Interna-tional Trade Classification; 3. Nomenclature of the Council of Customs Cooperation (Brussels customs nomenclature) [17; 29]. These international nomenclatures were built on the basis of various classification criteria and had a different degree of detailing of the circulation of goods, which made it difficult to compare the data of the commodity structure of export-import operations and the formulation of various concepts. The unified commodity nomenclature of foreign trade (members of CMEA) was prepared by the Department of Statistics of its Secretariat, issued in 1962 and used as the main classifier in international economic relations of the former USSR until 1991 [28; 42]. The main criteria for the systematization of goods were *their origin* and *degree of processing*. In addition, this classification of the nomenclature

system made it possible to divide goods into means of production and consumption items, into fixed assets and working capital, industrial and agricultural products. It made it possible to carry out additional grouping of exports and imports according to various economic characteristics. On the other hand, *the unified com-modity nomenclature of foreign trade of the Council of Economic Mutual Assistan-ce* included 9 sections, 57 commodity groups, 325 subgroups and 4,200 commodity items and more than 10,000 sub-items. At the same time, unlike other, it contained nomenclature an additional «zero» section, which included production operations (section No. 0 meant «material service operations») [29; 51 – 52].

However, this did not make it possible for the customs tariff to become a truly effective trade and political instrument and to perform the proper functions of the relevant economic regulator of foreign economic activity [3].

UN Standard International Trade Classification (UN SITC). It was presen-ted by the UN Statistical Commission according to the version proposed by the ses-sion of the UN Economic and Social Council on July 12, 1950, which accepted the following proposal: «...Taking into account the feedback from governments and specialized agencies regarding SITC, the recommended classification can serve as the basis for the analysis of international trade..., be the basis for the provision of data on trade statistics to international organizations, the UN requests governments to use the following *Standard International Trade Classification* by: 1) adopting it with such changes as may be necessary to meet national needs without disturbing classification schemes. 2) regrouping its statistical data according to such a scheme in order to achieve comparability of international trade data» [46].

The classification of goods in the UN SITC was carried out according to several characteristics, the main one of which is the sequence of processing of pro-ducts. At the same time, all goods in it are divided into 3 main classes: finished products, semi-finished products and raw materials. Such grouping was combined according to the purpose of the goods, but was applied only in relation to the zero and first sections.

It is worth noting that this classification system also had a number of shortco-mings. Thus, individual sections were not sufficiently detailed. For example, chapter 7 «Machines, equipment and vehicles» consisted of only three subdivisions, which did not take into account the presence of a large nomenclature of goods from this heading. In addition, a very significant shortcoming of the UN SITC is that it did not have a breakdown by the relevant branches of the national economy [28; 42].

One of the most popular commodity classification systems is the nomenclature of *the Customs Cooperation Council (CCC).* It was developed on the basis of *the Brussels Customs Nomenclature (BCN)*, which began to operate in 1955. In its first version, the nature of the material from which the goods were made was taken as the main classification feature. In 1959, 1965, and 1972, additions and amendments were made to it in accordance with the criteria of economic statistics - generalized indicators from such categories as machines, equipment, raw materials, and goods were grouped by the degree of their processing and by industry origin. And the work on the convergence of the main classifications (UN SITC and BCN) led to the creation of a new draft of the Brussels nomenclature, which was named *the Nomen-*

clature of the Customs Cooperation Council. In contrast to the initial version of the BCN, the classification scheme of the new nomenclature was based on such characteristic as the degree of processing and the origin of the goods. A very important feature of the NCCC is that the product code sections (fonts) are not numbered. This nomenclature is built on four-digit marked goods, that is, they are divided into 99 groups, regardless of their belonging to one or another section, numbered in ascending order from 01 to 99.0, within the group, goods are numbered in ascending order by two characters. NCCC was used and is used by many countries of the world (mainly Western European states) both for statistical purposes and as a merchandising basis for the formation of relevant national customs tariffs. *The Combined Nomenclature of the European Economic Community* was built on the basis of the NCCC (it was put into practice on January 01, 1988) and *the Harmonized System of Description and Coding of Goods*, which is used essentially by all states of the European Union and the world [38].

Conclusions. In the course of the study, it was found that *relations between Ukraine and the European Union* were initiated in December 1991, when the Minister of Foreign Affairs of the Netherlands, as the country presiding over it, *officially recognized the independence of Ukraine in a letter on his behalf*, and later the Free Trade Zone between by them and in the future, on February 28, 2022, it *submitted an application for membership in the European Union*. Despite the unfavorable economic conditions, the product structure of its exports to the European Union remasned stable According to the results of 2020, the share of EU states in Ukraine's foreign trade was 40.7 %, ***so it avoided such a humiliating status*** *as a raw material appendage of the European Union and became its full-fledged partner in trade in goods and services*, ***and in 2022*** the export of goods from Ukraine to the European Union increased by 4.2 % to 28.0 billion US dollars. The study of these processes made it possible to come to the conclusion that ***foreign economic policy*** is the activity of the state to regulate its economic relations with other countris, which is formed on the basis of the territory and practice of the market economy. Its foundation in the foreign economic policy of any state is its constitution and national traditions and norms of international agreements. *The policies of free trade and protectionism* are the most common in global practice. ***The policy of free trade*** provides for the removal and reduction of restrictions on foreign economic activity, free access to capital and labor, national product markets. ***Protectionism*** is a type of state policy aimed at protecting the domestic market from foreign competition using a system of appropriate restrictions, which is implemented through the introduction of customs-tariff and non-tariff instruments for regulating foreign trade, the appropriate use of which is especially important under the conditions of Ukraine's European integration as ***a real possibility further improvement of the welfare of employees***.

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