

Частина I



**СТУДЕНТСТВО.  
НАУКА.  
ІНОЗЕМНА МОВА**

**Збірник наукових праць**

Міністерство освіти і науки України

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ІНОЗЕМНА МОВА**

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У збірнику подано статті іноземними мовами з викладенням результатів наукових досліджень студентів, аспірантів та молодих науковців у різних галузях, що можуть зацікавити світову наукову спільноту. Регулярні публікації робіт допоможуть виявити талановиту студентську молодь, здатну брати участь у міжнародному професійному, науковому та освітньому обміні та втілювати одержаний досвід у розвиток передових технологій.

Усі матеріали публікуються в авторській редакції.

<b>ARCHITECTURE AND CONSTRUCTION.....</b>	<b>10</b>
<b>Artyukhova O.M. STRENGTHENING OF REINFORCED CONCRETE STRUCTURES WITH COMPOSITE MATERIALS.....</b>	<b>10</b>
<b>Bilous A.O. AKTUELLE PROBLEME BEI DER ABWASSERREINIGUNG.....</b>	<b>16</b>
<b>Fitarov V. S. APPLICATION OF COMBINED PILE-RAFT FOUNDATIONS IN DESIGN OF BRIDGE STRUCTURES.....</b>	<b>20</b>
<b>Kosmachevsky V. V. NODE CONNECTIONS IN WOODEN STRUCTURES.....</b>	<b>24</b>
<b>Odainyk D. R. NATURAL WATER BODIES AS AN ELEMENT OF SUSTAINABLE ARCHITECTURE AND A METHOD FOR REVITALIZING URBAN ECOSYSTEMS .....</b>	<b>27</b>
<b>Postnikov I. S. USE OF MODERN MATERIALS IN THE CONSTRUCTION OF EXPANSION SEAMS IN CEMENT CONCRETE PAVES.....</b>	<b>30</b>
<b>Sychova D. I. TECHNOLOGICAL INNOVATIONS IN THE FIELD OF ROAD CONSTRUCTION.....</b>	<b>35</b>
<b>Sypchenko V. O. RESEARCH ON THE TENSILE STRENGTH OF VARIOUS TYPES OF STONE-MASTIC ASPHALT CONCRETES.....</b>	<b>38</b>
<b>Verbytskyi S.M. MODERN METHODS OF FACADE RENOVATION.....</b>	<b>41</b>
<b>HUMANITIES.....</b>	<b>46</b>
<b>Belova P.S. SENSORY INTEGRATION THROUGH THE PRISM OF THE EDUCATIONAL PROCESS IN HIGHER EDUCATION INSTITUTION.....</b>	<b>46</b>

<b>Buriak D. Y. THE PSYCHOLOGY OF INTERPRETING.....</b>	<b>48</b>
<b>Dehtiarov M. S. THE DUAL IMPACT OF SOCIAL MEDIA ON MODERN SOCIETY.....</b>	<b>52</b>
<b>Hrytsai K. M. PECULIARITIES OF FOREIGN LANGUAGE EDUCATION IN THE ERA OF INDUSTRY 5.0.....</b>	<b>55</b>
<b>Ivaniuk A.O. PRESERVATION OF CULTURAL HERITAGE THROUGH DIGITIZATION.....</b>	<b>63</b>
<b>Konotop K. O. THE VITAL ROLE OF HUMANITIES IN SHAPING A BALANCED AND PROGRESSIVE SOCIETY.....</b>	<b>67</b>
<b>Koptiev R.O. THE EVOLUTION OF LEGAL STANDARDS FOR PROSECUTORS IN A DIGITAL AGE.....</b>	<b>71</b>
<b>Lupienos A. O. ADAPTATION OF ENGLISH FOR FOREIGNERS IN ENGLISH-SPEAKING COUNTRIES.....</b>	<b>75</b>
<b>Lykhman Y. V. PSYCHOLOGICAL CHARACTERISTICS OF PERSONALITY RESPONSES TO VIOLATIONS OF PERSONAL BOUNDARIES.....</b>	<b>79</b>
<b>Mohnatkina A. O. CURRENT PROBLEMS OF ORAL, WRITING, INDUSTRIAL, ARTISTIC TRANSLATION.....</b>	<b>82</b>
<b>Nikiforova S.M., Hasanenko L.O. ENGLISH IDIOMS THAT REFLECT CULTURAL VALUES.....</b>	<b>86</b>
<b>Schtscherbyna D.I. ENTWICKLUNG DES STEUERSYSTEMS DER UKRAINE.....</b>	<b>89</b>
<b>Sierykh D. S. FOSTERING ACADEMIC INTEGRITY IN LANGUAGE LEARNING: THE CRUCIAL ROLE OF SCAFFOLDING FOR UNIVERSITY STUDENTS.....</b>	<b>93</b>
<b>Sokolova A. O. EMOTIONS AND EXPERIENCES OF INDIVIDUALS DURING WAR: A PSYCHOLOGICAL PERSPECTIVE.....</b>	<b>98</b>
<b>Tkachenko O.V. DER EINSATZ VON PROJEKTARBEIT IM FREMDSPRACHENUNTERRICHT.....</b>	<b>102</b>

<b>Turadze R. A. CELTIC INFLUENCE ON THE ENGLISH LANGUAGE.....</b>	<b>106</b>
<b>Tykhonova M. Ye. USING DIGITAL TOOLS DURING DISTANCE LEARNING IN FOREIGN LANGUAGE LEARNING.....</b>	<b>111</b>
<b>Zakipna A. O. PSYCHOLOGICAL FOUNDATIONS OF MODERN HR MANAGEMENT.....</b>	<b>113</b>
<b>ECONOMIC SCIENCES.....</b>	<b>117</b>
<b>Bezpala V. S. THE ROLE OF INNOVATION IN ENHANCING COMPETITIVENESS OF SMALL AND MEDIUM-SIZED ENTERPRISES IN THE MODERN BUSINESS ENVIRONMENT.....</b>	<b>117</b>
<b>Butenko D. S. THE LAND MARKET IN UKRAINE: KEY ASPECTS AND IMPLICATIONS.....</b>	<b>120</b>
<b>Derevianko O. M. CURRENT ASSETS OF THE ENTERPRISE: CONDITION AND EFFICIENCY.....</b>	<b>124</b>
<b>Dovhopol O. Y. CONCEPTUAL PRINCIPLES FOR THE FORMATION OF SUSTAINABLE DEVELOPMENT OF AN ENTERPRISE.....</b>	<b>128</b>
<b>Kamal S. E. RISK MANAGEMENT OF FOREIGN ECONOMIC ACTIVITY OF A BANKING INSTITUTION.....</b>	<b>134</b>
<b>Kukharyk V.V. INFLATION: ESSENCE, CAUSES, TYPES AND SOCIO-ECONOMIC CONSEQUENCES.....</b>	<b>137</b>
<b>Lytvyniuk O. V. GREEN ECONOMY AS A CATALYST FOR SUSTAINABLE DEVELOPMENT.....</b>	<b>141</b>
<b>Polienko K.A. THE ROLE OF STATISTICS IN ECONOMICS .....</b>	<b>144</b>
<b>Pronin O. S. DEVELOPING AN INTERNATIONAL STRATEGY FOR BANKING ENTERPRISES.....</b>	<b>149</b>
<b>Riznyk I. Ye. THE TRANSFORMATIVE IMPACT OF DIGITALIZATION ON GLOBAL ECONOMIES AND SOCIETIES .....</b>	<b>152</b>
<b>Semchenko M. IMPACT OF GLOBALIZATION ON MODERN ECONOMIES.....</b>	<b>155</b>

<b>Sumtsov B. Ye. THE ROLE OF CRYPTOCURRENCIES IN THE MODERN ECONOMY AND THEIR IMPACT ON TRADE.....</b>	<b>159</b>
<b>INFORMATION TECHNOLOGIES.....</b>	<b>163</b>
<b>Aleksandrov M. S. PYTHON AS A PROGRAMMING LANGUAGE.....</b>	<b>163</b>
<b>Alkema P. A. THE POSSIBILITIES OF MOBILE APPLICATIONS FOR LEARNING ENGLISH.....</b>	<b>165</b>
<b>Asaienko Y. S. NEURONET AUTOTRANSFER ARCHITECTURE ENHANCEMENT.....</b>	<b>168</b>
<b>Barashkov V. S. 5G AND FUTURE COMMUNICATION.....</b>	<b>172</b>
<b>Benzionovich M. O. ARTIFICIAL INTELLIGENCE IN OUR LIVES.....</b>	<b>175</b>
<b>Bielikova D. S. ARTIFICIAL INTELLIGENCE: A CHANCE FOR THE FUTURE OR A DANGER?.....</b>	<b>178</b>
<b>Bilyk A. D. ADVANTAGES OF AZURE SEARCH INDEX OVER TRADITIONAL RELATIONAL DATABASES IN INFORMATION SEARCH TASKS.....</b>	<b>180</b>
<b>Filipiev Ye. S. AI-POWERED LANGUAGE LEARNINHG: INNOVATIONS, CHALLENGES AND OPPORTUNITIES.....</b>	<b>184</b>
<b>Frizel V. V. THE IMPACT OF DIGITALIZATION ON THE LABOR MARKET: NEW PROFESSIONS AND SKILLS.....</b>	<b>188</b>
<b>Harbuz S. I. AGENT-ORIENTED PROGRAMMING.....</b>	<b>193</b>
<b>Hetman D. O. ARTIFICIAL INTELLIGENCE: OPPORTUNITIES AND CHALLENGES.....</b>	<b>195</b>
<b>Ivanova S. I. THE ROLE OF ARTIFICIAL INTELLIGENCE IN SHAPING OUR CONSCIOUSNESS.....</b>	<b>198</b>
<b>Ivantsook O. S. BUILDING MOMENTUM TO REALIGN INCENTIVES TO SUPPORT OPEN SCIENCE.....</b>	<b>203</b>
<b>Kolenchenko Ya. S. POTENTIAL AND DANGERS OF ARTIFICIAL INTELLIGENCE FOR SOCIETY.....</b>	<b>205</b>

<b>Kovtun D. O. OPPORTUNITIES AND THREATS OF ARTIFICIAL INTELLIGENCE.....</b>	<b>208</b>
<b>Kovtun Yu. S. ARTIFICIAL INTELLIGENCE FOR CREATING 3D VIDEO GAME MODELS.....</b>	<b>211</b>
<b>Krainiuk M. Yu. INTEGRATION OF AI AND IOT INTO THE MANAGEMENT OF MACHINE AND TRACTOR UNITS.....</b>	<b>214</b>
<b>Kuznetsov A.R. UNREAL ENGINE 5: ANALYSIS OF OPPORTUNITIES AND DEVELOPMENT PROSPECTS.....</b>	<b>219</b>
<b>Kyrylov D. I. ARTIFICIAL INTELLIGENCE.....</b>	<b>223</b>
<b>Levenets E. V. ARTIFICIAL INTELLIGENCE: BENEFITS AND THREATS .....</b>	<b>226</b>
<b>Melnyk V. O. INFORMATION TECHNOLOGIES FOR OPTIMIZATION OF WAREHOUSE OPERATIONS.....</b>	<b>229</b>
<b>Miroshnichenko D. V. GRAVITY ROADS: REVOLUTIONIZING URBAN INFRASTRUCTURE FOR A SUSTAINABLE FUTURE.....</b>	<b>234</b>
<b>Morkova V. O. ARTIFICIAL INTELLIGENCE: PROGRESS OR RISK?.....</b>	<b>237</b>
<b>Muliavka D. O. OPTIMIZING MANUFACTURING PROCESSES WITH ARTIFICIAL INTELLIGENCE.....</b>	<b>240</b>
<b>Nasatov O. I. INNOVATIVE APPROACHES TO ENSURING INFORMATION SECURITY IN C# LANGUAGE.....</b>	<b>245</b>
<b>Novoseletska K.S. ENHANCING ACCESSIBILITY IN HUMAN-COMPUTER INTERACTION: STRATEGIES AND TECHNOLOGIES.....</b>	<b>249</b>
<b>Oleynik D. D. PROSPECTS AND RISKS OF ARTIFICIAL INTELLIGENCE DEVELOPMENT.....</b>	<b>252</b>
<b>Oliinyk V. V. USES AND DANGERS OF ARTIFICIAL INTELLIGENCE .....</b>	<b>255</b>



<b>Polupan A. V. THE WAY TO IT: WHO IS A TESTER AND WHY IS IT PROMISING.....</b>	<b>260</b>
<b>Popov Ya.D. ROBOTIC INTEGRATION IN OUR LIVES.....</b>	<b>263</b>
<b>Prudnykov M. Yu. ARTIFICIAL INTELLIGENCE.....</b>	<b>266</b>
<b>Prudnykov M. Yu. CYBERSECURITY DURING MILITARY HOURS: A KEY TO MODERN WARFARE.....</b>	<b>269</b>
<b>Rudenko R. M. SMART STOPS IN UKRAINE – A STEP TOWARDS A SMART CITY.....</b>	<b>271</b>
<b>Shagiyan R. S. THE IMPACT OF CLOUD TECHNOLOGY ON EDUCATION.....</b>	<b>273</b>
<b>Skakun M. S. INFORMATION TECHNOLOGIES FOR LANGUAGE LEARNING WITH ARTIFICIAL INTELLIGENCE.....</b>	<b>277</b>
<b>Skubanova O. O. ARTIFICIAL INTELLIGENCE IN CROSS-CULTURAL COMMUNICATION: THE POTENTIAL BENEFITS AND DANGERS.....</b>	<b>279</b>
<b>Stefantsiv A. V. ARTIFICIAL INTELLIGENCE.....</b>	<b>284</b>
<b>Suprun V. M. GAMIFICATION: THE IMPACT OF GAMES ON MODERN IT SOLUTIONS.....</b>	<b>287</b>
<b>Synkovskyi M.I. ARTIFICIAL INTELLIGENCE IN ROAD CONSTRUCTION.....</b>	<b>291</b>
<b>Tarasov Ye. M. ARTIFICIAL INTELLIGENCE: APPLICATION IN THE FUTURE PROFESSION AND DEVELOPMENT PROSPECTS.....</b>	<b>296</b>
<b>Tolkachov M. S. OPPORTUNITIES AND CHALLENGES IN A DIGITAL WORLD.....</b>	<b>300</b>
<b>Tovstoluh D. V. THE ROLE OF BLOCKCHAIN TECHNOLOGY IN FORMING THE ECONOMY OF THE FUTURE.....</b>	<b>304</b>
<b>Volobuieva V. S. POTENTIAL BENEFITS AND DANGERS OF ARTIFICIAL INTELLIGENCE.....</b>	<b>307</b>

<b>Zadorozhna A.O. ARTIFICIAL INTELLIGENCE IN THE MODERN WORLD.....</b>	<b>310</b>
<b>Zarytskyi O. V. USE OF AR TECHNOLOGIES IN THE URBAN ENVIRONMENT.....</b>	<b>312</b>
<b>Zdykhalskyi V. A. THE ROLE OF DIGITALISATION IN MODERN HR MANAGEMENT.....</b>	<b>315</b>
<b>Zemlianoi O. A. APPLICATION OF CLOUD PLATFORMS FOR STORAGE AND PROCESSING OF VEHICLE ROUTES DATA: COMPARISON OF AWS, AZURE AND GOOGLE CLOUD PLATFORMS FOR ROUTING SYSTEMS DEVELOPMENT.....</b>	<b>319</b>
<b>Zhuha A. S. ARTIFICIAL INTELLIGENCE: A PATH TO PROGRESS OR A DANGER?.....</b>	<b>323</b>
<b>Zhukovskyi V. E. THE ROLE OF ARTIFICIAL INTELLIGENCE IN CYBERSECURITY.....</b>	<b>326</b>
<b>Zubenko I. A. ARTIFICIAL INTELLIGENCE - OUR FUTURE OR THE ABYSS?.....</b>	<b>329</b>
<b>Zui V. A. ARTIFICIAL INTELLIGENCE: PROGRESS OR RISK?.....</b>	<b>331</b>

# ARCHITECTURE AND CONSTRUCTION

**Artyukhova O.M.**

## **STRENGTHENING OF REINFORCED CONCRETE STRUCTURES WITH COMPOSITE MATERIALS**

*Scientific Advisor – Assoc. Prof. Suprun O.U.s.l. of Technical Sciences*

*Language Advisor- Assoc. Prof. – Plotnikova N.V. Doctor of Philological Sciences*

The development of construction is impossible without the use of new building materials and technologies. Increasingly, the technology of strengthening reinforced concrete elements with composite materials based on fiber-reinforced polymers (FRP) is gaining popularity. Due to its low self-weight, high tensile strength, and ease of installation, this method has the potential to take a leading position among "classical" methods of strengthening reinforced concrete structures.

In recent years, extensive research has been conducted to determine the effects of composite materials based on fiber-reinforced polymers on the load-bearing capacity of reinforced concrete elements under bending. However, the impact of this method on the strength of inclined sections of reinforced concrete elements remains insufficiently explored, particularly in domestic literature.

There is no universally accepted theory or methodology for calculating the strength of inclined sections of reinforced concrete elements when strengthened with composite materials based on fiber-reinforced polymers. Considering that the practical application of this method is complicated by the lack of comprehensive design guidelines, existing international methodologies have been analyzed, and key aspects requiring further refinement have been identified.

External reinforcement using composite materials is a modern and efficient technology that significantly increases the strength and durability of construction elements. Due to their unique properties, composites are finding increasing applications in construction and repair.

The need to strengthen structural elements can be driven by the following main factors:

- Increased design loads on the structure, caused by modernization of production technologies, changes in the functional purpose of building premises or engineering structures, or increased capacity requirements.
- Loss of load-bearing capacity or operational qualities of a structure due to accidents, physical wear, reinforcement corrosion, or the aggressive effects of the environment.
- Changes in the dimensions of buildings or structures, such as alterations in internal layouts, spans, heights, or column spacing.
- The necessity to increase the load-bearing capacity of a structure through additional reinforcement due to errors in its design, manufacturing, transportation, assembly, or operation.
- Identification of unfavorable material qualities or changes in design conditions compared to the original specifications during inspection and diagnostics.
- Special operational conditions, such as seismic or anthropogenic impacts (earthquakes, fires, disasters, explosions, etc.).

Strengthening building structures with polymer concrete composite materials involves increasing the cross-sectional area of an element. This method was first applied in 1953 to reinforce a roadbed in Sacramento, California.

Since the 1950s, various innovative methods have been developed to enhance the effectiveness of epoxy adhesives. These adhesives allowed for the attachment of additional reinforcement using polymer solutions, bonding of metal sheets, attachment of fiberglass fabric, and integration of individual elements. However, due to underdeveloped technology, widespread use of these methods was premature at the time.

The essence of the new technology lies in compensating for insufficient load-bearing capacity by bonding special fabrics made of carbon and glass fibers—

or ready-made elements from these materials—to the surface of structures using modified and epoxy resins. Reinforcement with polymer composite materials is applied to improve load-bearing capacity, crack resistance, stiffness, seismic resistance, and resistance to dynamic and impact loads.

The choice of materials for structural rehabilitation depends on addressing design flaws, construction defects, increased structural loads, combating concrete and reinforcement corrosion, and reducing crack widths and excessive deflections. Successful development and selection of reinforcement methods and materials require a systematic approach that assesses the condition of the entire system, i.e., "reinforced structure – reinforcement element." Regardless of the selected method, a key requirement is that the system functions as a unified entity. This is achieved through adequate adhesion between the concrete and external reinforcement, ensuring the components work as a single monolith.

Composite materials can include ceramic, metal, or polymer matrices. Depending on the matrix used, the mechanical properties of these three composite classes vary significantly. Polymer matrices have relatively low strength and elasticity modulus; ceramic matrices are highly strong and rigid but extremely brittle; while metal matrices exhibit intermediate strength and modulus values and are very ductile.

The most common forms of composite reinforcements include fabrics with various weaves, strips, or plates. Fabrics are flexible textiles with unidirectional or bidirectional fiber arrangements. When applied to structures, they are embedded in a polymer adhesive matrix that ensures tight adhesion to the surface and increases their strength. This method of composite application is referred to as "on-site."

Fiber composites are made of fibers (carbon, polyester, aramid, etc.) laminated in polymers to form rigid strips or plates, which are directly bonded to specially prepared structural surfaces. Commonly known as "laminates," these materials offer a practical solution for structural reinforcement. Another prevalent

type is composite fabrics, used as flexible materials that are impregnated on-site with adhesive polymers for direct application to surfaces.

The physical and mechanical properties of composite materials are determined by the type and amount of fibers used, their orientation, and distribution in the cross-section of the strip. The polymer's role is to transfer acting stresses between fibers and protect them from external impacts.

Composite materials have a solid foundation of successful testing and implemented projects for restoring and strengthening load-bearing structures. Their further adoption as a primary method for structural element repair promises benefits in reduced capital investments, labor, material consumption, and execution time. This underscores the importance of further studying these materials and exploring ways to expand their industrial applications.

Since Ukraine has not developed regulatory documents for the calculation and design of reinforced concrete bending elements strengthened with composite materials, it is recommended to consider the following provisions when creating such a document:

1. When calculating the strength of inclined sections of reinforced concrete bending elements strengthened with composite materials, the following parameters must be accounted for:

- physical and geometric characteristics of the strengthening elements,
  - Wrapping scheme,
  - Bonding in the contact zone between the composite material and concrete,
  - Effective length of the composite material,
  - Type of failure of the FRP (Fiber Reinforced Polymer).

1. To facilitate the practical use of the calculation methodology, all parameters should either be known or derived from simple interdependencies.

A deeper analysis of existing calculation methodologies reveals several issues that require further clarification, including:

- The impact of additional anchoring devices on the type of failure in strengthening elements,
- The relationship between the percentage of internal transverse reinforcement and composite materials when determining their effect on the shear strength of reinforced concrete elements,
- The long-term performance of reinforced concrete elements strengthened with composite materials, considering the formation of cracks in the contact zone between "concrete-FRP,"
- The influence of composite materials located in the tensile zone of concrete on the strength of inclined sections.

What about destruction of composite material. This kind of destruction is possible only with poor-quality surface treatment, with improperly designed amplification and when the loads acting on the structure exceed the maximum values adopted in the project.

Depending on the initial point of the process of destruction, can be distinguished 4 types of destruction .

Type 1. Destruction begins in the cracked anchoring zone. The composite material can peel off in this zone as a result of crushing of concrete under the action of shear stresses on the contact of the layers.

Type 2. The peeling of the composite occurs as a result of the formation of flexural cracks from the action of the external load. Cracks in the concrete, initially normal to the longitudinal axis of the element, may further extend horizontally. The strip of composite material will peel off in the central part of the structure, away from the anchoring zones.

Type 3. Detachment of the composite as a result of the formation of inclined cracks as a result of the combined action of normal and tangential stresses, and which can be dominant in the peeling of the strip of composite material. However, in structures with sufficient internal and external transverse reinforcement, the

formation of such cracks is unlikely and detachment of the composite material is possible only with insufficient lateral reinforcement.

Type 4. The detachment of composite material can be caused by uneven surface of concrete. The unevenness and roughness of the concrete surface are stress concentrators and as a result can cause the initial local loss of adhesion of the CMB strip to concrete, which can spread further and cause detachment.

Conclusion: Reinforcement using fiber-reinforced polymer composites is becoming increasingly popular alongside the "classical" reinforcement method. Most research focuses on the effect of such reinforcement on the strength of normal cross-sections in bending reinforced concrete elements.

At the same time, the impact of reinforcement on the strength of inclined sections remains insufficiently explored from both theoretical and practical perspectives. There is no unified and generally accepted computational methodology, and existing methods often yield contradictory results.

Additionally, there are a number of unresolved issues in this area. In Ukraine, no regulatory document currently exists that provides a calculation methodology for the strength of inclined sections of concrete bending elements reinforced with composite materials, which significantly slows the development of this method.

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**Bilous A.O.**

**AKTUELLE PROBLEME BEI DER ABWASSERREINIGUNG**

*Sprachwissenschaftlicher Leiter – Kand. techn. W., Doz. Ratschkowskij A. W.*

Schätzungsweise sind heute zu jeder Zeit mehr als zehn Milliarden Tonnen Ballastwasser mit Schiffen auf den Weltmeeren unterwegs einschließlich den darin mitgenommenen Mikroorganismen und Lebewesen. Sie lassen auf diese Weise die normalerweise unüberwindbare Barriere der Ozeane hinter sich. Die Internationale Maritime Organisation (IMO) hat in einem Übereinkommen klare Regeln aufgestellt, wie Ballastwasser behandelt werden muss, um diese Gefahr für die aquatischen Ökosysteme weltweit zu verhindern. Die bislang noch nicht ratifizierte Konvention legt fest, dass nur Ballastwasser in Häfen abgegeben werden darf, das

durch eine entsprechende Behandlung einen vorgeschriebenen Standard (D-2-Standard des Ballastwasser-Übereinkommens) erreicht. Mehr als 30 000 Schiffe, die auf den Meeren ihren Dienst tun, werden ein Ballastwasser-Behandlungssystem nachrüsten müssen, sobald die IMO-Konvention in Kraft tritt.

Die internationalen Bemühungen um den Schutz der aquatischen Ökosysteme machen eine Behandlung des Ballastwassers von Schiffen unerlässlich. Ein neues System kombiniert dazu Filtration und UV-C-Desinfektion.

Es gibt schon erste Untersuchungen. Die GEA Westfalia Separator Group hat mit dem Ballast Master Ultra V ein System zur Behandlung des Ballastwassers an Bord von Schiffen entwickelt, das im Jahr 2012 durch das Bundesamt für Schifffahrt und Hydrographie die Typengenehmigung zur Behandlung von Ballastwasser (G8) nach IMO EntschlieÙung MEPC. 174 (58) erhielt. Es nutzt Filtration und UV-C-Behandlung, um einen hohen Grad an Sicherheit bei der Inaktivierung von Phytoplankton, Zooplankton, Bakterien, Viren, Fischlarven und Sedimenten im Ballastwasser zu erzielen. Ballast Master Ultra V arbeitet mit niedrigen Energie- und Betriebskosten, benötigt keine Chemikalien und ist sowohl zur Installation in neuen Schiffen als auch zur Nachrüstung geeignet.

Es werden Filtration und UV-C-Desinfektion durchgeführt. Der Ballast Master Ultra V wird direkt im Anschluss an die Ballastwasser-Pumpen des Schiffs installiert. Zum System gehört eine mechanische Filtration mit einem selbstreinigenden Ansaugprozess als Vorbehandlungsschritt. Mittels 20 µm- Sinter-Filter- und Absaugreinigungstechnologie ist die Filtrationstechnik in der Lage, Organismen, Partikel und Sediment zu entfernen. Die Nachbehandlung des Wassers geschieht mittels Niederdruck-UV-C-Strahlung. UV-C-Strahlen zur Desinfektion sowie Ultraschall zur Reinigung der Quarzrohre haben sich bereits in der mobilen Abwasserbehandlung bewährt. Zur Wasserdeshinfektion werden üblicherweise zwei verschiedene UV-Techniken genutzt, die sich in ihrem Emissionsspektrum unterscheiden.

Mitteldruck-UV-Lampen (MPUV) emittieren Lichtstrahlen über eine große Bandbreite von UV- und sichtbarem Licht. Bei der MPUV-Technologie können chemische Nebenprodukte entstehen. Niederdruck-UVL-Lampen (LPUV), wie sie im Ballastklaster Ultra V zur Anwendung kommen, emittieren monochromatisches Licht mit der spezifischen Wellenlänge von 254 nm, um den Effekt der Inaktivierung zu nutzen und die Bildung von möglichen Nebenprodukten zu verhindern.

Der UV-C-Prozess desinfiziert sowohl das Filtrationskonzentrat als auch das filtrierte Wasser vollständig. UV-C ist auch wirksam gegenüber spezifischen, chemieresistenten pathogenen Keimen, weil Mikroorganismen keine Resistenz gegenüber UV-Licht aufbauen können. Die physikalischen Eigenschaften des Ballastwassers, wie pH-Wert oder Salzgehalt, bleiben von UV-C unbeeinflusst.

Ultraschall wird für die Selbstreinigung verwendet. Zur Selbstreinigung der UV-C-Quarzrohre wird Ultraschall-Technologie eingesetzt. Dank dieser wirksamen Behandlung kommt der Ballast Master Ultra V komplett ohne chemische Additive aus. Der völlige Verzicht auf Chemikalien schützt nicht nur die Crew und die Umwelt, sondern vermeidet auch Korrosionseffekte im Rohrleitungs- und Tanksystem der Schiffe.

Die gesamte Installation arbeitet vollautomatisch und wird im Automatikmodus fernüberwacht. Alle Anlagenteile sind auf einfache Bedienung und niedrige Wartungskosten ausgelegt. Neben dem bereits typgenehmigten Ballast Master Ultra V bereitet die GEA Westfalia Separator Group derzeit Tests für den BallastMaster ecoP (Elektrolyse) vor, die in der zweiten Jahreshälfte 2013 erfolgen sollen. UV-Technologie ist wirtschaftlich prädestiniert für Durchsatzleistungen bis zu 1500 Kubikmeter pro Stunde. Für höhere Ballastwasserkapazitäten ist der Ballast Master Eco P unter Verwendung der Elektrolyse geeigneter.

In enger Zusammenarbeit mit Eignern und Werften hat die GEA Westfalia Separator Group geprüft, welche Systeme und Technologien die Schifffahrt in Zukunft benötigt, um sowohl die Schiffe ökonomisch betreiben zu können als auch

direkten Schutz der Meere und der Seen zu gewährleisten. Von den ausführenden Werften kamen Forderungen nach niedrigen Investitionskosten, einem geringen Platzbedarf der Aggregate sowie einer einfachen Installation und kurzfristiger Lieferung. Die Schiffseigner sind neben den niedrigen Investitionskosten an einem problemfreien Betrieb mit geringen Betriebskosten interessiert. Der Punkt einer wartungsarmen Technologie tritt immer stärker in den Vordergrund, da häufig die Schiffsbesatzungen nicht optimal ausgebildet sind. Von hoher Bedeutung für die Betriebskosten ist vor allem auch die Frage nach dem Energiebedarf. Der Ballast Master Ultra V ist nur ein Teil der Produktfamilie „Seaprotectsolutions“.

Weitere Systeme bereiten mit zentrifugaler Trenntechnik anfallende Schlämme oder Bilgewässer auf oder gewinnen mittels Wärmetauscher Energie zurück. Hinzu kommen moderne Separatoren zur Schmieröl- und Treibstoffaufbereitung.

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**Fitarov V. S.**

**APPLICATION OF COMBINED PILE-RAFT FOUNDATIONS IN DESIGN OF BRIDGE STRUCTURES**

*Scientific Advisor – Cand. Tech. Sc, Assoc. Prof. Ovcharenko O. A.*

*Language Advisor – DSc, Prof. Saienko N. V.*

**Combined pile-raft foundation**

A combined pile-raft foundation (CPRF) is a system that performs the functions of transferring loads from the structure to the soil and consists of three components that perform load-bearing functions: group of piles, raft foundation and ground base.

In total, during the operation of foundation structures consisting of piles and raft, four types of interaction between the foundation and soil can occur: pile-soil, raft-soil, pile-pile, and raft-pile. In the case of the combined pile-raft foundation, in addition to piles, raft is involved in the operation, which adds to the interaction of the foundation with the soil of the types "pile-soil" and "pile-pile" also the interaction of the raft with the soil "raft-soil" and the interaction of the raft with piles "raft-pile" (Katzenbach et al., 1998).

A combined pile-raft foundation is a system in which the loads to the soil are transmitted both through the raft and through the pile component, and are described by equality (1). At the same time, the main criterion for assessing the interaction of elements is the pile-raft coefficient, which corresponds to the ratio of the sum of the loads taken by the pile component to the total load from the structure, and is described by equality (2). If this coefficient is 0, then the pile-raft system works as a raft foundation, and if 1, then as a pile foundation. In order for the pile-raft system to work as a combined pile-raft foundation, identity (3) must be satisfied.

$$(1) \quad P_{\text{tot}} = P_r + \sum P_p$$

where:

$P_{\text{tot}}$  – total load from the structure;

$P_r$  – load taken by the raft;

$\sum P_p$  – sum of loads taken by the pile component.

$$(2) \quad \alpha_{\text{pr}} = \frac{\sum P_p}{P_{\text{tot}}}$$

where:

$\alpha_{\text{pr}}$  – pile-raft coefficient.

$$0 < \alpha_{\text{pr}} < 1$$

(3)

The performance of a pile-raft system can be quantitatively described by the dependence of the pile-raft coefficient on the ratio of the settlement of the combined pile-raft foundation ( $S_{\text{pr}}$ ) and the settlement of the raft foundation ( $S_r$ ). This dependence is graphically displayed in Figure 1 below (Katzenbach, & Choudhury, 2013).

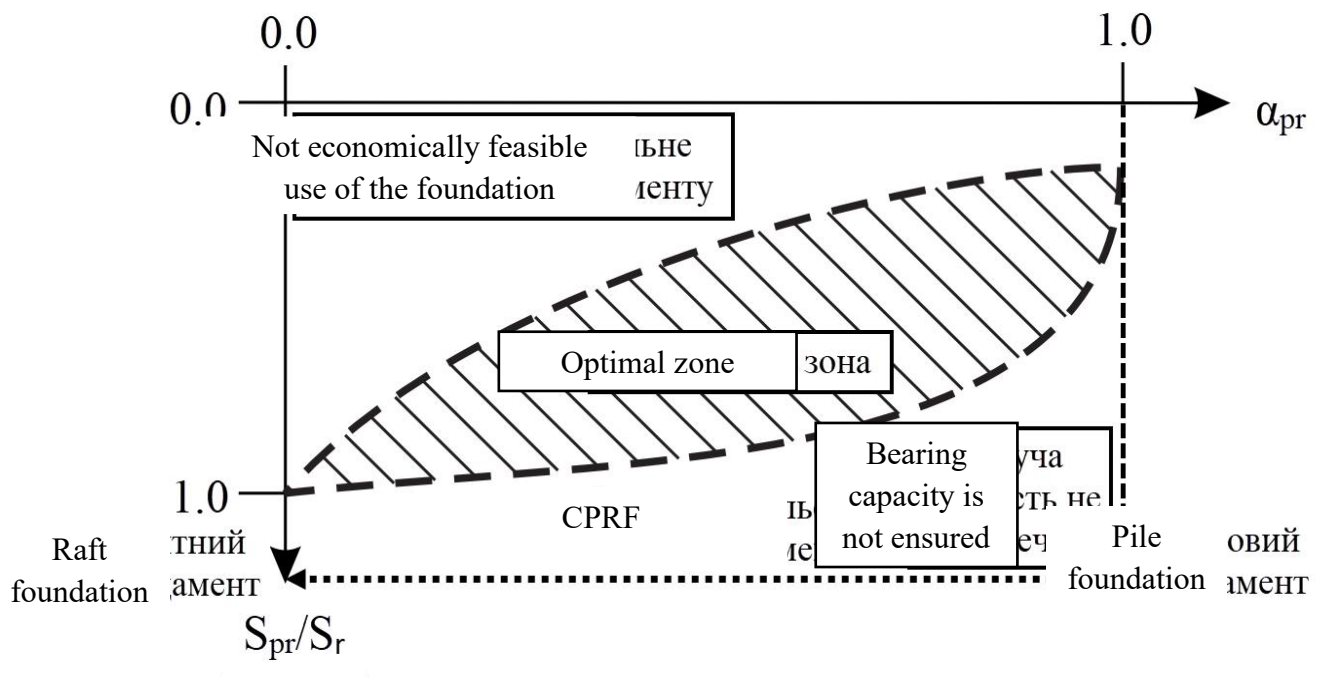


Figure 1. Quantitative display of the work of the pile-raft system

Main advantages of CPRF are as follows:

- reduced settlement and slope;
- increased bearing capacity of shallow foundations;
- reduced bending stress in the slab;
- reduced costs;
- reduced material usage;
- reduced CO<sub>2</sub>.

#### Application experience

The problem of combined pile-slab foundations has been actively studied in the international geotechnical community since the mid-20th century. It should be noted that despite the fact that scientific research on this topic has been conducted since the mid-1950s, the most extensive and accurate studies have been carried out since the 1990s, when electronic capacities allowed calculation operations to be performed on personal computers.

Over the past few decades, a global trend is the growth in the number of facilities using combined pile-slab foundations. This is due to the availability of modern calculation systems, as well as the accumulation of a bank of experience in the design, construction and operation of foundations of this type.

The results of the research are a number of structures around the world built with the use of combined pile-slab foundations, such as the Messeturm, Taunusturm, European Central Bank and others.

#### Experience of application in Ukraine

The only examples of projects using CPRF in Ukraine are Mirax Plaza Tower A (Kyiv) and Avalon Upside residential complex (Lviv), which is currently at a construction stage.

#### Regulatory documents

Methods for calculation of combined pile-raft foundations are not presented in the Ukrainian State Building Codes (DBN) and Eurocodes. Usually, the ISSMGE Combined Pile-Raft Foundation Guideline is used for calculations. The

first building codes for the design and construction of CPRF will be published in India in the near future.

#### Relevance of the topic

Modern construction of bridge structures requires solving diverse geotechnical problems and developing new types of structurally reliable and economically justified foundations in difficult engineering and geological conditions.

In the worldwide practice of bridge and other structures construction in the last twenty years, one of the progressive developments is the combined pile-raft foundation, where the loads from the structure are distributed between the piles and the raft. The choice of effective solutions for such foundations depends on many factors: the characteristics of the soil conditions, the parameters of the piles and the step between them, the stiffness of the raft, the model of the foundation and the nature of the interaction between piles, raft and soil, etc. Therefore, the calculation of the system "ground base – pile-raft foundation – structure" is possible only using numerical methods, which are implemented in powerful computer software such as PLAXIS, ANSYS, ABAQUS, SOFISTIK, MIDAS and FLAC 3D, where various individual approaches to modeling such systems with a significant number of assumptions are taken, which, as a rule, do not have a full-fledged experimental base.

It is important to note that the CPRF has never been used in bridge construction projects in Ukraine. Therefore, the study of pile-raft foundations for bridge structures and the development of scientific basis for their calculation and design is a relevant direction in soil mechanics and foundation construction in Ukrainian practice, as well as in the post-war reconstruction of Ukraine.

In the absence of DBN and Eurocodes for the design of CPRF, the future studies can become a basis for further implementation of design rules in regulatory documents.



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**Kosmachevsky V. V.**

### **NODE CONNECTIONS IN WOODEN STRUCTURES**

*Language Advisor – Candidate of Philological Sciences,  
Asst. Prof. Plotnikova N. V.*

Node connections in wooden structures play a crucial role in creating reliable and long-lasting construction projects. The stability of structures under external loads, weather conditions, and mechanical impacts depends on the quality and proper execution of these joints. When designing and manufacturing connections, it is essential to consider not only the mechanical properties of the wood but also the specifics of the connected elements and the operating conditions of the structure.

One of the critical characteristics of wooden joints is their ability to adapt to various types of loads, including tension, compression, bending, and torsion. For example, adhesive joints, which are gaining popularity in modern construction, enable the uniform distribution of loads and eliminate stress concentration points, reducing the risk of cracks and failures. Additionally, such joints provide airtightness, preventing moisture ingress and extending the service life of the connections.

Combined joints, which simultaneously use mechanical and adhesive fastening elements, are also widely applied. This approach ensures high strength and reliability, even under significant dynamic loads. Examples include wooden

trusses or frame elements where nodes constructed with metal plates and adhesive compounds withstand repeated bending and torsional loads.

Moreover, the stability and durability of wooden node connections are significantly enhanced through the use of eco-friendly materials and technologies. The application of modern adhesive compounds based on natural components, as well as wood with improved physical and mechanical properties, minimizes environmental impact and increases the energy efficiency of structures. Thus, innovative solutions in the field of node connections not only extend the lifespan of constructions but also promote the development of sustainable building practices that meet contemporary environmental standards.

An important direction in the development of node connections is the implementation of modular technologies, which significantly accelerate the assembly process of structures on construction sites. Prefabricated high-precision nodes manufactured under factory conditions minimize human error and ensure standardized installation quality. This is especially relevant for large-scale construction projects where speed of erection and cost control are critical. Such technologies also simplify the repair and replacement of individual components, enhancing the operational flexibility of structures and reducing their overall ownership costs.

The technologies for manufacturing joints are also constantly evolving. Digital design methods, such as load modeling using specialized software, are now widely employed. These tools optimize joint construction, select optimal materials, and predict the behavior of connections under stress. Furthermore, modern wood-processing methods, including precision milling and drilling, ensure tight-fitting elements and eliminate the need for on-site adjustments.

Additional protection for joints is provided through wood treatment with antiseptics to prevent decay and the application of water-resistant coatings. Adhering to construction norms and standards, such as DBN B.2.6-161:2017 or EN

1995-1-1:2010, which regulate the strength calculation and durability of joints under various operating conditions, is also crucial.

Thus, advancements in wooden joint technologies allow for the creation of not only strong and reliable but also aesthetically appealing structures that meet the highest demands of modern construction. The combination of traditional connection methods, such as mortise-and-tenon or dowel joints, with innovative solutions makes wooden structures a universal choice for both residential and industrial projects.

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**Odainyk D. R.**  
**NATURAL WATER BODIES**  
**AS AN ELEMENT OF SUSTAINABLE ARCHITECTURE**  
**AND A METHOD FOR REVITALIZING URBAN ECOSYSTEMS**

*Language Advisor – Candidate of Philological Sciences,  
Asst. Prof. Plotnikova N. V.*

Water architecture has always been important throughout human history. It has not only sustained life but also played an important role in shaping the urban environment. It has facilitated trade, nourished agricultural lands, and provided a sense of place and identity to different communities.

The role of water bodies in the urban environment has changed and presented itself in different ways over time, and these spaces have often been neglected in numerous ways, particularly by a certain type of urban planning that disregarded their potential in favor of other imperatives, such as road transport and industrial equipment. This approach has caused many environmental, architectural and social problems, such as the decline and pollution of water areas, the lack of proper recreational areas and the failure to use the potential of the city's green and water spaces (Moises Carrasco, 2024).

In recent decades several initiatives have been proposed to reimagine and transform previously underutilized or degraded water bodies into active public spaces that can be used by the entire population. These regenerated spaces can accommodate a variety of practices, such as recreation and leisure, cultural events, various forms of exercise and even greater contact with nature, an experience that may be rare in some cities.

Another important aspect of many of these projects is their role in the restoration of previously polluted water bodies, often in collaboration with ecosystem rehabilitation and environmental maintenance, especially in the face of environmental and climate crises (Adele Belitardo, 2023).

One of the ways to solve worldwide environmental and urban problems is WSUDP program. Water-Sensitive Urban Planning and Designing is an approach

that integrates and optimizes the use of available water sources and completes the water cycle by incorporating various strategies into urban planning and design. This method aims to lower the hydrological impact of urbanization and present opportunities for improved water management.

Key components of WSUDP include:

1. Protecting Local Waterbodies: safeguarding lakes, ponds, and wetlands to serve as supplementary water sources.
2. Storm-Water Management: utilizing landscape design elements such as vegetated swales, buffer strips, and bio-retention systems to manage stormwater in public spaces.
3. Recycling and Reusing Wastewater: implementing low-cost, low-energy methods to treat wastewater, viewing it as a resource rather than a liability.
4. Increasing Water Conservation: promoting water-efficient fixtures, xeriscaping, and efficient irrigation methods to reduce the load on municipal supply systems and groundwater sources. Rainwater harvesting is also emphasized to mitigate water scarcity.
5. Enhancing Social and Ecological Value: designing the built environment to meet community needs and address water issues.
6. Connecting the Urban Water Cycle: collaborating with practitioners from different disciplines to integrate diverse perspectives and expertise.
7. Policy Integration: aligning new policies, regulations, and approvals with WSUDP principles (Urban Design Lab, 2024).

One of successful examples of restoring and using water spaces in accordance with established programs and standards is Minhang Riverfront Regeneration. The project objective was to transform a dilapidated, overgrown river embankment facing low-grade industrial warehouses with the remains of paths, industrial and abandoned utilities. The design of the riverfront includes continuous green ribbons of walking, jogging and bicycle tracks and 3 pedestrian bridges that link the residential, education and business communities

together. The landscape was designed by layering four distinct zones that enhance views create and for the first time accessibility to the river. The linear zones take on an abstracted riparian form and house innovative pockets of activity with lawns, cafés, a sports park and event plaza (SPARK, 2021).

Another example of the restoration of a virtually destroyed recreational water area is the renovation of Rachel de Queiroz Park. Occupying one of the city's flooded preservation areas, the project adopted the drainage system as a structural element. The wetland technique was used to improve the water quality of the Riacho Cachoeirinha, as well as to create a flood dampening system. After intensive hydrological studies, nine interconnected ponds were proposed to perform a natural water filtering process through decanting and phytoremediation. This process is conducted by microorganisms fixed both on the surface of the soil and on the roots of aquatic plants in the ponds (Architectus S/S, 2022).

So in today's rapidly urbanizing world, where cities dominate the landscape, water is being rediscovered as a means of ecological regeneration. There is a growing movement to reopen and re-naturalize urban waterways to restore them as vital ecological corridors within the city. More and more cities are now looking towards the water in an attempt to reconnect with nature and create spaces where urban life and natural ecosystems can coexist harmoniously. This growing trend reflects a deeper understanding of water not just as a resource, but as a bridge to a more sustainable and resilient future for our cities.

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**Postnikov I. S.**

**USE OF MODERN MATERIALS IN THE CONSTRUCTION OF  
EXPANSION SEAMS IN CEMENT CONCRETE PAVES**

*Scientific Advisor- Ph.D. Kostin D.Y.*

*Language Advisor- Asst.prof. Vorobyova S.V*

Expansion seams are an integral part of cement concrete pavements. They are designed to compensate for thermal deformations of concrete, prevent cracking and pavement destruction. Traditionally, materials such as bituminous mastics, asphalt corks and wooden slats were used for expansion joints. However, these materials do not always meet modern requirements for durability, tightness and noise insulation.

seam type	Scheme	Description
transverse expansion joints		1 - base layer; 2 - metal rod; 3 - basket frame; 4 - elastic material; 5 - bitumen coating; 6 - rubber or polyethylene cap; 7 - air gap; 8 - seam groove filled with sealing material;

Figure 1 - Expansion joint design

#### Advantages of using modern materials

Modern materials for expansion joints have a number of advantages over traditional materials, namely Increased service life: Modern materials are more resistant to wear, abrasion and chemicals, which significantly increases the service life of expansion joints. Increased tightness: Modern materials provide better sealing of the joints, which prevents the penetration of water and dirt, as well as the formation of cracks. Reducing noise levels: modern materials have better soundproofing properties, which reduces traffic noise. Reduced operating costs: due to their durability and airtightness, modern materials reduce the cost of repairing and maintaining expansion joints.

#### Examples of modern materials

##### Silicone sealants:

Advantages: high elasticity; Resistance to temperature extremes (-50°C to +150°C); Resistance to chemicals; Water resistance; Good adhesion to concrete;



Durability; Disadvantages: high cost; Need for special equipment for application; The use of sealants for joint filling began more than a hundred years ago in the early 1900s. Over the years of technical development and progress, three main approaches to sealing joints have emerged: joint filling (Fig. 2a), joint filling (Fig. 2b) or a combination of both (Fig. 2c).

a) pouring                      b) filling (compaction)                      c) combination  
(filling + pouring)

Figure 2 - Methods of sealing joints Bituminous mastics:

Advantages: Low cost; Ease of application; Water resistance; Resistance to temperature changes ( $-40^{\circ}\text{C}$  to  $+80^{\circ}\text{C}$ ) Disadvantages: low elasticity; Unstable to chemicals; Fragile; Requires periodic repairs An alternative to using hot bituminized sealing materials is the use of ready-made sealing elements for joints. This technology originated in the 1960s when the production of prefabricated sealing elements was launched. They differ from other sealants in that they are ready to install without heating, mixing or curing. After installation, the finished sealing joints are compressed only under lateral pressure, which ensures their effective operation over a long period of operation. The main material for prefabricated seals is neoprene, a synthetic rubber that provides sealing of the seam during compression. The seals usually consist of a series of bridges that provide elasticity and pressing against the walls of the cavity. Manufacturers supply gaskets in different widths and depths to meet the requirements of any project. The width of the gasket must be greater than the maximum width of the joint cavity, and the depth of the cavity must exceed the depth of the gasket when compressed.

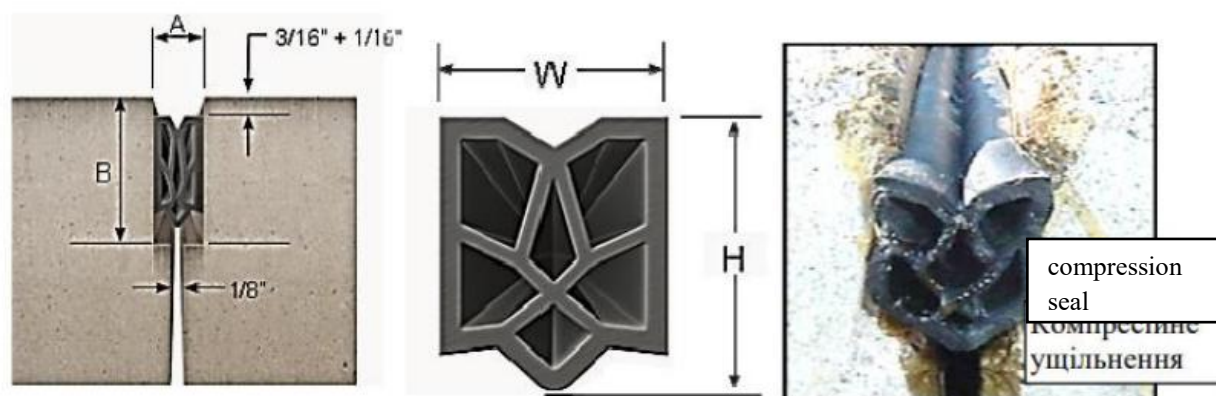




Figure 3 - Typical seam construction for E and V series seam seals and pre-formed seam seals

Installing the sealing profile in the seam. The installation of the profile eliminates the use of mastic, sealing cord and hot-melt boilers. In small sections, as an exception, the profile is rolled out along the seam line and carefully tucked into the seam (Fig. 4). Using a wooden mallet or a special pneumatic hammer, the final installation of the sealing material into the seam is performed. Only two people are required to perform the work.

Figure 4 - Sealing profile installation sequence

Sizes and physical and mechanical properties of seam seals. Standard sizes of joint seals in the form of finished profiles are shown in Table 1. Properties: PROOFMATE EBF are sealing profiles of various sizes based on EPDM (copolymerized propylene diene). The European standard EN 14188-3: 2006 does not specify the use of adhesives and primers in the application of sealing profiles. However, the experience of recent years in the construction and operation of airfield pavements indicates the expediency of their use. For example, PROOFMATE EBF is used for sealing expansion and contraction joints together with FIX-O-FLEX F adhesive. Thanks to the high-quality material, the finished profiles can also be used in areas exposed to chemical and/or UV exposure.

Profile	Name	Seam width, mm	Seam depth, mm	Profile width, mm.	Profile	Name	Seam width, mm	Seam depth, mm	Profile width, mm.
	EBF6	6	15	11		EBF15	15	25	22





	E	8	2	1		E	2	3	3
BF8		5	3,5		BF20	0	2	2	
	E	1	2	1		E	2	3	4
BF10	0	5	6		BF25	5	2	0	

Figure 5 - Table 1 - Appearance and sizes of finished profiles for filling joints

Polymer sealants: Advantages: High elasticity; Abrasion resistance; Chemical resistance; Water resistance; Good adhesion to concrete; Durability Disadvantages: High cost; Geotextiles: Advantages: Reinforcement of expansion joints; Prevention of soil and sand penetration into the joints; Increase in joint life Disadvantages: the need for additional installation;

#### Material selection

The choice of material for expansion joints in cement concrete pavements depends on several factors, such as type of pavement: for high traffic highways, it is recommended to use more wear-resistant materials such as polymer sealants. Climatic conditions: in regions with harsh winters, frost-resistant materials such as silicone sealants are recommended. Budget: modern materials can be more expensive than traditional materials such as bitumen mastics.

#### Recommendations

It is recommended to consult a specialist before choosing the material for expansion joints. It is important to lay the material correctly to ensure its durability. Expansion joints should be inspected regularly and repaired in a timely manner. The use of modern materials in the construction of expansion joints in cement concrete pavements can significantly increase the service life of the pavement, reduce noise and reduce maintenance costs.

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**Sychova D. I.**

### **TECHNOLOGICAL INNOVATIONS IN THE FIELD OF ROAD CONSTRUCTION**

*Language Advisor – Asst. Prof. Chevychelova O. O.*

Modern road construction is undergoing a remarkable transformation, driven by the growing need for infrastructure that can endure heavy traffic, extreme weather conditions, and increasing environmental pressures. The challenges faced by today's road construction industry are complex, and meeting these demands requires innovative solutions. Advanced materials, smart technologies, and automation are revolutionising how roads are designed, built, and maintained. These innovations not only enhance the efficiency and longevity of road infrastructure but also play a crucial role in ensuring sustainability and reducing the environmental footprint of construction activities.

One of the most promising advancements in road construction is the development of self-healing asphalt. This innovative material incorporates microcapsules containing rejuvenators that activate under heat or stress, repairing cracks that form naturally over time. The self-healing mechanism extends the lifespan of roads, reduces maintenance requirements, and lowers long-term costs for road agencies. In addition, the use of recycled materials, such as plastics and rubber from tyres, has gained traction. These materials improve the elasticity of asphalt and its resistance to weathering, making roads more durable while also reducing waste and promoting sustainability.

Smart technologies are playing an increasingly vital role in road infrastructure. The integration of Internet of Things (IoT) sensors into road surfaces allows for real-time monitoring of key parameters such as traffic loads, temperature, and wear. These sensors provide valuable data that can be used for predictive maintenance, helping to identify and address issues before they lead to major problems. By enabling better resource allocation and more efficient management of road infrastructure, IoT technologies improve both the quality of roads and the cost-effectiveness of maintenance operations. Another cutting-edge innovation is the concept of solar roadways. Roads integrated with photovoltaic panels not only function as transport routes but also generate renewable energy. This energy can be used to power streetlights, traffic signs, and nearby facilities, contributing to the reduction of energy costs and supporting the transition to greener technologies.

Automation and robotics are also reshaping the road construction process. Automated paving systems enable more precise and faster construction, reducing the potential for human error and improving overall road quality. Drones are being used to provide aerial surveys and mapping, offering valuable insights for planning and monitoring construction projects. These technologies reduce construction time, cut labour costs, and ensure higher standards of quality in road infrastructure. The combination of robotics and automation significantly improves efficiency, making the construction process faster and less reliant on human intervention.

The environmental impact of road construction is a growing concern, and addressing this challenge has led to the development of more eco-friendly practices. Traditional road construction methods are known to contribute significantly to carbon emissions, which has led to the exploration of alternative materials and practices aimed at reducing the carbon footprint. Low-carbon concrete and bio-based binders are increasingly being used, alongside energy-efficient machinery and electric construction vehicles, to lower emissions during construction. These efforts align with broader environmental goals and help make road construction more sustainable. Additionally, the design of green roads has become a central focus for many engineers. Green roads incorporate practices such as planting vegetation alongside roadways, constructing wildlife crossings to prevent animal collisions, and using permeable pavements that absorb rainwater and reduce runoff. These features not only contribute to biodiversity but also mitigate the environmental impact of road infrastructure.

Waste management and recycling are also at the forefront of modern road construction. The use of technologies like cold in-place recycling (CIR) allows old asphalt to be repurposed on-site, reducing the need for new materials and conserving resources. Recycling construction debris and using it to create new road materials helps to lower the volume of waste sent to landfills and contributes to a more sustainable construction process. These practices are vital in reducing the environmental footprint of road construction and supporting the shift toward a circular economy.

In conclusion, technological innovations in road construction are vital for creating infrastructure that is durable, efficient, and environmentally responsible. With advancements such as self-healing asphalt, recycled materials, and smart technologies like IoT sensors and solar roadways, the industry is significantly improving road lifespan, reducing maintenance costs, and contributing to sustainability. Automation and robotics enhance precision and efficiency in construction, further reducing costs and time. Environmental sustainability is also

at the forefront, with low-carbon materials, electric vehicles, and green road designs helping to reduce emissions and conserve resources. These innovations are shaping the future of road construction, ensuring that infrastructure meets the growing demands of modern society while minimizing environmental impact. The ongoing development of these technologies promises to build roads that are more resilient, eco-friendly, and cost-effective for the generations to come.

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**Sypchenko V. O.**

### **RESEARCH ON THE TENSILE STRENGTH OF VARIOUS TYPES OF STONE-MASTIC ASPHALT CONCRETES**

*Science Advisor – Cand. Tech. Sc, Assoc. Prof. Kostin D. Yu.*

*Language Advisor – DSc (Education), Prof. Saienko N. V.*

Stone-mastic asphalt (SMA) was developed in Germany during the 1960s and is now widely used worldwide for constructing road surface top layers. Its asphalt mix features a high proportion of fractionated crushed stone (60–80% by mass) with a cube-like grain shape to form a stable mineral framework in the pavement. Compared to traditional hot mixes, SMA contains more bitumen (5.5–

7.5%), which enhances the layer's moisture resistance, aging durability, water and frost resistance, crack resistance, and overall longevity. In some countries, pavements made with SMA can last over 20 years.

The increased bitumen amount in the mixture requires stabilization to prevent it from draining off the surface of the crushed stone particles and to avoid mixture segregation at high processing temperatures during production, storage, transportation, and laying. This issue is effectively addressed by adding a stabilizing agent, such as cellulose fiber, to the mixture.

Stone-Mastic Asphalt (SMA) offers several advantages over traditional asphalt mixes:

- Increased Durability: SMA's high stone content and stable mineral framework significantly extend pavement life.
- Higher Resistance to Rutting: The coarse aggregate skeleton provides superior load-bearing capacity, reducing deformation under heavy traffic.
- Improved Moisture Resistance: A higher bitumen content and stabilizers reduce moisture penetration, preventing water-related damage.
- Enhanced Crack Resistance: SMA is less prone to cracking due to its flexible binder and stabilized structure.
- Superior Resistance to Aging: The mix resists oxidation better, maintaining its properties longer under environmental exposure.

The mineral materials for the experiment were taken from the Haivorin quarry. The stone materials were fractionally separated, and average granulometric compositions for four types of stone-mastic asphalt (SMA) mixes were calculated, meeting the requirements outlined in (1). Bitumen grade BND 60/90 was used as the binder, and Viatop 66 was added to stabilize the drainage properties. The physical and mechanical characteristics of the tested asphalt mixtures comply with the standards specified in (1).

The Department of Road Construction and Maintenance at KhNAHU has developed a method for determining the tensile strength limit under uniaxial



tension. The method involves subjecting an asphalt concrete sample to tension using a specialized device, as shown in Figure 1.

Figure 1 – Specialized device for determining tensile strength limit

To conduct the test, the sample must be prepared as follows:

- trim the sample edges using a disc cutter;
- apply adhesive to both the sample surface and the specialized metal plates, then allow sufficient time for the adhesive to cure;
- thermostat the sample to the required temperature;
- mount the sample in the device attached to the press and apply loading at a rate of 3 mm/min.

The direct tensile strength measurement results are presented in Table 1.

Table 1 – Breaking force of the sample for different types of SMA.

<i>Asphalt type</i>	<i>Sample breaking force, N</i>
SMA-5	3920
SMA-10	3332
SMA-15	2891
SMA-20	2587

The overall appearance of the samples after testing is shown in Figure 2.

Figure 2 – Overall appearance of the samples after testing (SMA-2 and SMA-20)

Based on the research results, the following *conclusions* can be made: the use of this testing method allows for directly obtaining the tensile strength limit values; as the maximum size of mineral grains in the SMA composition increases, a decrease in strength characteristics is observed.

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Міністерство будівництва, архітектури та житлово-комунального господарства України.

**Verbytskyi S.M.**

**MODERN METHODS OF FACADE RENOVATION**

*Scientific Advisor – Assoc. Prof. Gurkalenko V.A., Doctor of Technical Sciences*

*Language Advisor – Assoc. Prof. Plotnikova N.V., Doctor of Philological Sciences*

In modern cities, under the influence of adverse weather conditions, building facades require renovation. With the advancement of construction technologies, the reconstruction of old facades is no longer a significant challenge. Aging and deterioration are natural and inevitable processes, especially in our harsh climate. Therefore, facades require timely repairs, as they are not only the "face" of buildings but also ensure protection against environmental and biological influences.

The main measures for facade maintenance, repair, and reconstruction consist of a set of construction activities aimed at restoring or improving the building's exterior. This includes the application of various technologies, specialized materials, and mechanized tools.

Facade maintenance and repair involve the following actions: planned inspections, unscheduled inspections, current repairs, major repairs, and facade restoration (for architectural monuments and valuable historical buildings).

For engineering assessments of structural conditions, licensed project and survey organizations are involved as needed. If balconies, bay windows, loggias, or canopies are found to be in an emergency condition, their use is prohibited, and measures are taken to address the identified defects.

Minor structural defects are addressed during inspections or repairs. If defects cannot be fixed through minor repairs, facades are included in the major repair plan.

The established maintenance interval for building facades is 10 years, while buildings located in city centers or along major roads require maintenance every 5 years. Early repairs, if necessary, must be justified by technical inspections indicating the causes of premature wear and tear.

In accordance with legislative requirements, title lists should include provisions for complying with directives from state control and supervision bodies regarding the mandatory restoration or repair of facades within the specified timeframes.

Facade repair work includes cleaning from contamination, plaster repair, cladding repair, and painting. In some cases, work to address damage to brick masonry, cornices, stucco decorations, and other architectural elements may also be included.

Before starting facade repairs, roofing and drainage repairs from roofs, balconies, and entrance canopies must be completed. To prevent damage, polished plinths, sculptures, and other decorative elements of the facade should be covered with plywood or wrapped with durable paper. Areas for pedestrian and vehicle traffic should be fenced off.

The facade repair process involves a set of operations aimed at restoring or improving the building's exterior. These are various technologies and construction operations involving the use of materials and methods to extend the service life of the facade. The repair process includes: obtaining technical specifications for facade repairs, analyzing and determining optimal methods and technologies, assessing the condition of the facade, collecting additional data for selecting repair technologies, obtaining necessary permits for facade repairs from city authorities, and executing an approved scope of work. The work may include technologies such as thin-layer thermal insulation, reinforced decorative plastering, smooth facade finishing, and facade cladding, with related work carried out by partner organizations or contractors.

The first operation in facade repair and finishing is cleaning from contamination. Washing installations, water tanks, and rubber hoses are used for washing. The main cleaning method is sandblasting or hydro-sandblasting.

When repairing facade plaster on stone buildings, unstable or detached plaster is removed, the wall surface is scored, and masonry joints are cleaned to a depth of up to 1 cm. The surface is then blown and washed, followed by plastering in three layers: spray, base, and finish coat. Remaining parts of the old plaster serve as guides. When partially replacing plaster, solutions close in composition to the original material are used.

The technology for facade painting is similar to that for interior painting, using mechanized or spray-painting devices. Paint is applied in an even layer without drips. Painting work is divided into sections, with sizes determined by the daily output of the team. Painting begins from the top floor.

For durability and protection against atmospheric influences, as well as preventing stains and efflorescence, facade surfaces are treated with hydrophobic solutions or fluates. Hydrophobization involves applying water emulsions of organosilicon liquids, such as GKZh-10 and GKZh-11, to the facade surface. Hydrophobic solutions are applied using spray guns or manually with brushes. The quality of hydrophobization is selectively checked by spraying water droplets onto a 100 m<sup>2</sup> section of the facade. If water is not absorbed within 20–30 minutes, the hydrophobicity of the surface is satisfactory.

Defects in the finishes of prefabricated panel buildings include cracks on facade panels, rust stains from corroded metal elements in contact with external surfaces, unfilled joints between ceramic tiles, and detached cladding tiles.

Various tools and equipment are used in facade repair: washing installations for cleaning, sandblasting devices, compressors, plastering machines, and spray guns for painting. For lifting workers (no more than two persons), materials, and tools to the work area, and for horizontal movement, self-elevating platforms are employed.

The overall level of mechanization in facade repair work is approximately 28%. The simplicity and reliability of construction characterize the compressor-less nozzle for plastering work. It consists of a body, diaphragm, and cap nut. Using this nozzle for plastering facades saves up to 7% of the solution. Spray guns for various types of paint have been developed and implemented for facade painting. It has been noted that pneumatic and air-mechanical spray guns, which disperse paint using compressed air, have drawbacks, including high air consumption, significant losses due to mist formation, and the presence of a second hose, which complicates worker actions and reduces productivity. It is also necessary to consider the possible stratification of some paints (lime, silicate, etc.).

In the near future, universal automated installations for facade repairs will be introduced on a large scale. These installations will perform sandblasting, "shaggy" plastering, and painting of blind facades.

### Conclusion

Facade renovation is an inevitable "healing" procedure for almost any structure. The main question is how well the building was constructed and when it will require such assistance. Facade repair has entered folklore as jokes and anecdotes due to the difficulties it often causes for both customers and contractors. However, it is unavoidable unless your building is an Egyptian pyramid. Facade repair often concerns not only old estates but also involves full restoration where historians strive to recreate and preserve the original appearance of the building. In such cases, questions arise about both the internal modernization of a structurally sound but outdated building and the investment required for facade repairs, as it represents the building's character and identity.

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# HUMANITIES

**Belova P.S.**

## **SENSORY INTEGRATION THROUGH THE PRISM OF THE EDUCATIONAL PROCESS IN HIGHER EDUCATION INSTITUTIONS**

*Language Advisor - Senior Lecturer Ryabovol G.S.*

Relevance: Training future specialists is a delicate process that affects the formation of future society, so this process should be treated with great responsibility. It is necessary to consider each student's individual characteristics for more effective learning of the material. One of these features is sensory integration. Analysis of articles has shown that this topic, although relevant, still needs to be researched.

This paper will examine the potential impact of sensory integration on students' learning activities.

To begin, it is worth characterizing the definition of **sensory integration**. Sensory integration is an unconscious process in the brain that organizes information received through the senses and assigns meaning to the sensations we experience, filtering information and selecting what to focus on. (1) The problem of sensory integration is actively being studied by many scientists, such as E. Ayres, N. Antokhina, N. Burykina, M. Kozak, M. Linskaya and others.

This process influences the formation of interests and, consequently, priorities in learning.

The process of sensory integration involves such sensory systems as:

Basic:

1. Vestibular
2. Proprioceptive
3. Tactile

Peripheral:

1. Visual
2. Auditory
3. Olfactory
4. Gustatory (3).

The educational process and learning activities are primarily influenced by the primary sensory systems, as well as the auditory and visual systems.

Therefore, the quality of specialists' training depends not only on the depth of theoretical knowledge, practical skills and abilities, but also on developing creative abilities, the ability to perceive a dynamic situation, and assessing its information content. The peculiarities of sensory integration influence the formation of these skills. Application of personally oriented technology encourages the student to be an active interlocutor, a subject of educational activity and productive work, develops communicative dialogue abilities, and widens outlook.

Personality-oriented technology of education must meet the following requirements:

1. Ensuring the consideration of the pupil's subjective experience, particularly of early learning.
2. The teaching of the material is aimed at the expansion of knowledge, integration and transformation of individual experience into cognitive skills.
3. Integration of subjective experience of pupils with scientific knowledge.
4. Stimulation of self-evaluation and creating conditions for self-development, self-education, and self-expression.
5. Giving the opportunity to choose the content and form of educational tasks in accordance with individual goals and characteristics.
6. Evaluation of the results and the process of learning knowledge.
7. Organisation of the educational process as an active subjective activity of students. (2)

Based on these criteria, we can reason about the effectiveness of introducing sensory integration in the educational system. To understand this method's



effectiveness in forming future specialists, it is necessary to conduct several empirical studies. So, we will leave this topic for further scientific work. This paper focuses on analyzing the relevance and potential significance of implementing sensory integration in the educational process.

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**Buriak D. Y.**

## **THE PSYCHOLOGY OF INTERPRETING**

*Language Advisor – Asst. Prof. Beztsinna Z. P.*

Interpreting (oral translation) is a process of translating orally that what someone is saying from one language to another one. There are two types of it: simultaneous interpreting and consecutive interpreting. Simultaneous interpreters listen to the speaker and translate one's speech almost at the same time, the delay can be only a few seconds. Consecutive interpreters listen to the speaker, write some notes about it and translate what the speaker is saying after the speaker has completed the part of the speech. Both works are quite difficult, because they need to swap between both languages very quickly and deliver the right sense of

the speaking to the audience. So, oral translation is accompanied with extreme conditions, which require extraordinary linguistic and mental abilities.

It is necessary to analyse the features of realisation of the simultaneous interpreting by a specialist. There are three types of it:

1. simultaneous listening translation (needs special technical means: a special cabin where the interpreter is located during the conference; a microphone through which the conference participant listens to the text for translation, as well as headphones, thanks to which the translator perceives the original fragment of the speaker's speech;

2. simultaneous translation from paper media (uses the source text in written form, which he received before the performance);

3. simultaneous reading of pre-translated text (the translator has a completely translated text, but he or she needs to correct it during the speaker adds certain new details).

Simultaneous interpretation is characterized by perception of auditory of the message, complex memorization, time-limited switching of the specialist from one language to another, oral and one possible interpretations of the translation, simultaneous order of operations.

On the other hand, consecutive interpretation is an oral translation of the text after listening to it. The method of writing some information makes the extreme conditions more pleasant for the translators (they don't need to use the memory so much or to be worried about time limits, etc.) In this case, the psychological load is less than during the simultaneous interpretation.

So, interpreters are like mental sportsmen, they juggle languages and ideas simultaneously. These mental actions are called "cognitive load", which means doing some particular things at the same time. The interpreters' brain must analyse quickly received information, understand it in one language and give an accurate interpretation in another. It is a fascinating process that people's brain is able to do.

Being an interpreter (simultaneous or consecutive) requires to have an extraordinary ability of memory to hold and distinguish received information. Memory is the ability to store and replay previous impressions, experiences, as well as the reserve of impressions kept in the mind. There are 2 types of memory: short-term and long-term. These specialists must keep in their mind a lot of information that is not connected with topic of the conference such as being aware of the speaker, thinking about nuances of words and expressions (if it is a diplomatic conference) or technical accuracy (if they are scientific conferences and forums). As for the memory of a translator, it can and should be trained and developed. You can expand your short-term memory capacity by structuring the information you receive by transforming groups of words, phrases sentences into more compact elements of information, where the accent is usually on the predicate.

In the broadest meaning, stress is a state of high tension as a psychological reaction to various adverse factors (hunger, cold, physical or mental trauma, etc.) In medicine, physiology, and psychology, there are positive (eustress) and negative (distress) forms of stress. No matter what type of stress it is, its impact on the body has common features. If you are under continuous or repeated stress, the emotional pressure can stagnate and the body's functioning can degrade.

The high degree of professional responsibility of a translator for the result of communication can often be a reason for stress. In the process of consecutive interpreting, the translator takes on the functions of both the recipient and the sender of information, which proves the high degree of probability of developing communication stress.

One of the key features of a translator's professionalism is the ability to adapt to different conditions of translation. It is a set of qualities and characteristics that help the translator adjust to changing work situations. So, stress resistance and mental health are the duty of the translator.

Geneva researchers have studied how the brains of multilingual students work during translation and have found that simultaneous translation activates only

a few additional brain areas that are responsible for coordinating movements rather than understanding the meaning of phrases. This suggests that the translation process depends more on the coordination of already involved brain parts than on the activation of new ones.

The study proved the current approach in neurophysiology, which focuses on the coordination of different parts of the brain instead of analysing their individual functions. Scientists suggest that complex cognitive processes, such as translation, may be based on simpler actions evolutionarily.

These discoveries expand our understanding of how the brain coordinates thought processes and actions and may serve as a basis for further research into neural mechanisms.

Consequently, interpreters are mental gymnasts. This profession is full of stress factors that, generally, may lead to health problems. Interpreters should use their memory in the broader meaning, and it is vital to mention that they also need to improve it to make their work easier. Moreover, the study by Geneva researchers highlights that translation, especially simultaneous translation, is based on the coordination of already active brain areas rather than the involvement of new ones.

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**Dehtiarov M. S.**

## **THE DUAL IMPACT OF SOCIAL MEDIA ON MODERN SOCIETY**

*Language Advisor – Asst. Prof. Chevychelova O. O.*

Social media has emerged as a transformative force in recent decades, reshaping communication, societal norms, and human interaction. Platforms such as Facebook, Twitter, Instagram, and TikTok have connected billions of people worldwide and significantly influenced political, economic, and cultural landscapes. While it has revolutionised communication and brought numerous opportunities, social media also presents challenges that require critical examination and balanced strategies.

It has redefined communication by enabling instant connections through messaging, video calls, and live streaming, bridging geographical gaps and fostering global connectivity. At the same time, it has contributed to the decline of face-to-face interactions and the rise of digital dependency. The platform for self-expression has enriched digital identities, yet the pervasive nature of online communication has introduced issues like information overload, digital fatigue, and challenges to privacy.

The role of social media in political discourse is both empowering and concerning. On one hand, it has been pivotal in amplifying voices, fostering activism, and enabling grassroots campaigns to gain global attention rapidly. Movements such as #MeToo and Black Lives Matter are emblematic of its capacity to unite people around common causes. On the other hand, the rise of

misinformation, targeted propaganda, and political echo chambers has undermined informed debate and democratic processes. Governments and organisations must navigate the delicate balance between ensuring free expression and preventing harmful manipulation.

Economically, social media has transformed marketing, branding, and the job market, creating new career paths like digital marketers and content creators. While these opportunities underscore the importance of digital literacy, the gig economy and ethical concerns regarding data privacy and advertising demand attention. For businesses, social media has become an indispensable tool for customer engagement, data analytics, and brand development. However, the commercialisation of platforms raises ethical dilemmas, particularly regarding user privacy, targeted advertising, and misinformation in sponsored content.

Cultural shifts are another facet of social media's influence. Amplifying cultural exchange has allowed diverse voices to be heard, but the dominance of certain platforms risks cultural homogenisation. Despite this, marginalised communities have found platforms to share experiences and advocate for equality, although "cancel culture" and online harassment reveal darker aspects of digital discourse. Social media fosters a globalised culture where trends, art, and ideologies spread rapidly. However, the oversaturation of specific narratives and values can marginalise lesser-represented groups and lead to the loss of cultural uniqueness.

The psychological effects of social media are profound. It fosters belonging and support but has been linked to anxiety, depression, and low self-esteem due to the curated nature of online content. Its addictive features can interfere with productivity and mental health, yet it also provides access to mental health resources and support networks. Young users, in particular, are vulnerable to the pressures of maintaining a polished online persona, often leading to comparisons and unrealistic expectations. Nevertheless, social media has also fostered online

communities that provide emotional support, share valuable resources, and raise awareness for mental health issues.

Balancing the opportunities and challenges of social media is a key societal task. While it supports education, innovation, and disaster response, issues like cyberbullying and data breaches persist. Policymakers, educators, and platform developers must collaborate to create ethical digital ecosystems that prioritise digital literacy and responsible usage.

Social media represents a double-edged sword, offering unparalleled potential for connection and growth while posing risks to societal and individual well-being. Its influence permeates every aspect of modern life, making it essential to address its complexities with nuance and foresight. This requires a collaborative approach involving governments, educators, businesses, and individuals to develop strategies that maximise its benefits while mitigating its adverse effects.

The path forward lies in fostering a culture of accountability, transparency, and inclusion within digital spaces. Educational initiatives must emphasise digital literacy, equipping users with the skills to critically evaluate information, engage in constructive dialogue, and protect their mental well-being. Simultaneously, technological innovations should prioritise user privacy, ethical advertising, and robust safeguards against misinformation.

Ultimately, the potential of social media to drive positive change outweighs its challenges when managed responsibly. By nurturing an environment that values human dignity, diversity, and informed discourse, society can leverage social media as a force for empowerment, innovation, and unity in an increasingly interconnected world.

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**Hrytsai K. M.**

**PECULIARITIES OF FOREIGN LANGUAGE EDUCATION  
IN THE ERA OF INDUSTRY 5.0**

*Language advisor - Ph.D in Philology Ahibalova Tetiana Mikolaiivna*

Introduction. Technology-based rapid evolution has greatly influenced different events in the human life sphere, where higher education has been one of the most affected areas. Industry 5.0 is a concept denoting a change from the previous stages of industrial revolutions, focusing on human-machine collaboration, customization, and sustainability. In science, Industry 5.0 is also defined as a human-centered technology paradigm, strictly linking present and future needs for society and jobs (Barata & Kayser, 2023). In contrast to its predecessors, Industry 5.0 comprises human and artificial intelligence (AI), enabling efficient and seamless communication. The progression from Industry 1.0 to Industry 5.0 has clarified the concept of language acquisition, particularly in the context of



technological development. This awareness enables teachers to confidently evaluate the current status quo of foreign language education (FLE) and explain the current trends of the learners' community.

Analysis of recent research and publications. Current research activity is highly focused on the role of Industry 5.0 in foreign language education. Combining AI with human-centered design has been described as critical to developing individualized and adaptive learning settings. Barata and Kayser discuss the peculiarities of evolution from Industry 4.0 to Industry 5.0, focusing on sociotechnical transformation (Barata & Kayser, 2023). This transition is centered upon sustainability, optimization of resources, and social welfare as a progression from the automation-driven Industry 4.0. The authors characterize three research phases since 2018, showing a stepwise development toward anthropocentric innovation.

Meniado attributes Education 5.0 to Industry 5.0 and proposes that Digital Language Teaching 5.0 will change the ways of English language acquisition by overcoming the consequences of the COVID-19 crisis (Meniado, 2023). It is evident that this paradigm transition requires curriculum design, teaching practice, assessment, and effective pedagogic methodologies. As reflected in the Industry 5.0 period, it is emphasized that there is a demand for digital literacy among students to prepare for their future careers and that while the learners, in general, have a positive attitude toward English lessons, they generally lack the instrumental competencies for participating in a competitive academic and professional environment (Yosintha, 2020).

Researchers explore the application of AI-driven interventions such as Quipper (Maharani & Mulyadi, 2023) and focus on digital platforms such as YouTube (Sari, 2020). They stress the importance of the English language as the foundation of Industry 5.0 because it supports new approaches (such as virtual reality and gamified learning). Such approaches promote student engagement and

critical thinking and provide education relevant to the challenges of the fifth industrial revolution (Candrasari, Puspandari & Meisarah, 2024).

**Purpose.** This article is devoted to the specific features of foreign language acquisition in the context of Industry 5.0 and focuses on instructors' practical involvement in adapting teaching methods to the relevant students' needs. It will provide students with the opportunity to understand the degree to which an AI world is likely to pose challenges to them and how they can prepare to face the challenges.

The outline of the main research material. To appreciate how Industry 5.0 may affect foreign language learning, it is crucial to follow the trajectory of the previous industrial revolutions and the corresponding education they have had. Likewise, each phase of industrialization brought unique transformations in the community's practices, tools, and status of languages.

**Industry 1.0.** The arrival of Industry 1.0 was signified by the shift from hand work to mechanizing at the end of the 18th century. The invention of steam engines brought about a paradigm change in many fields that allowed mass production. Formal schooling systems were established within the educational sector, though language learning remained conventional, emphasizing rote memorization and grammar translation. The relationship between Industry 1.0 and language acquisition is an illustrative example of the essential role of formal education in learning a language. However, the limited tools available during this period restricted the potential for dynamic improvement.

**Industry 2.0.** At the end of the 19th and beginning of the 20th century, the Second Industrial Revolution put various technologies (e.g., electricity or mass production employing assembly lines) on the market that altered the circumstances in which goods were produced. Advances in communication media, including telephones and telegraphs, helped people learn languages because they became more efficient, global, and thus more interlinked across national boundaries. This phase set the stage for English to grow as a global lingua franca, particularly in

business and science. The growing requirement for international communication made English the vital language for various professional disciplines, a trend that continued in subsequent industrial revolutions.

Industry 3.0, which emerged in the post-World War II middle century, is characterized by the evolution of such principles and artifacts as computers, automation, and digital technologies. Language learning has been influenced by the introduction of audio-visual features, language laboratories, and computer-assisted language learning (CALL). These resources provided FLE with greater interactivity and inclusiveness. The connection between Industry 3.0 and language acquisition is also essential since this is the entry point to technology-based education. English continues to be the common medium of technology and globalization, so learning digital literacy in addition to language is no longer an option for the future but a necessity.

Industry 4.0 is defined by a digitalization process, the Internet of Things (IoT), big data, and artificial intelligence. It brought significant changes to education, particularly language learning. Online tools, mobile apps, and artificial intelligence-based language technologies emerged significantly, making FLE and personalized learning more prevalent. Nevertheless, Industry 4.0 main axes involve automation and efficiency and often neglect the presence of humans in the teaching process. This limitation lays the foundation for Industry 5.0, where machine-human symbiosis strives for a tradeoff between technological innovation and human creativity and individuality.

Industry 5.0. Compared to Industry 4.0, which is dominated by automation, Industry 5.0 is highlighted by anthropological direction. It aims at human creativity and well-being by embedding AI into daily life (while keeping a human essence). On the language learning side, this paradigm shift leads to a new emphasis on the human component of teaching so that language tuition, in its very nature, stays relevant and personal.

The progression of FLE through the industrial revolutions reflects significant shifts in teaching methods, tools, roles, challenges, and learning outcomes, culminating in a human-AI collaborative model in Industry 5.0.

A. Teaching methods. In Industry 1.0, teaching relied on traditional rote learning, where students memorized vocabulary and grammar rules. Industry 2.0 saw the development of formal schooling systems, emphasizing structured instruction. As a result of the evolution to Industry 3.0, digital tools and CALL started to play a crucial role, giving learning an interactive character. Industry 4.0 brought online and AI tools that changed the education landscape by focusing on personalized learning. In essence, Industry 5.0 integrates human and AI collaboration, with the weaving machine's capacity and human ingenuity serving as pivotal elements.

B. Teacher's role. The teacher's role has undergone significant transformation. In Industry 1.0, teachers acted as sole knowledge providers, dictating content and methods. The Industry 2.0 shift changed the role of a teacher from an organizer and guide (as in Industry 1.0) to an instructor and guide (as in Industry 2.0) to help students work their way through processes of prescribed learning. Industry 3.0 considered teachers as facilitators of using digital tools and as mentors in online environments. In Industry 5.0, teachers act as human-AI collaborators and coaches, guiding students through technology-embedded learning and skills development.

C. Student's role. In the same way, the role of students has also changed from passive to active. In Industry 1.0, learners were passive receivers of information taught without understanding the mechanism or why that information was relevant to their daily activities. Industry 2.0 fostered students toward active learning, a task specified by instructions. In Industry 3.0, students became active participants in digital education, utilizing emerging technologies. By Industry 4.0, they were supposed to be autonomous, self-driven participants, able to self-appraise their own learning paths. Industry 5.0 promotes students as creators in collaboration

with AI to develop both innovation and the ability to solve problems in tandem with technology.

D. Challenges. Every stage of industrial development has put different demands on language teaching. Industry 1.0 faced limited resources, restricting the availability of materials. Industry 2.0 faced the absence of cross-border communication, which has resulted in limited global interaction. Industry 3.0 emphasized the digital divide and a difference in access to technology. Industry 4.0 struggled with over-reliance on automation, potentially reducing the human aspect of learning. Industry 5.0 attempts to integrate technology with empathy and human interactivity, resulting in a complementary rather than inverse relationship between the two.

E. Learning outcomes. Learning objectives of every period are a consequence of its technological and educational focus. Industry 1.0 brought elementary literacy, which set the silting for the development of language education. Industry 2.0 emphasized functional language use, supporting practical communication. Industry 3.0 enabled advanced proficiency, equipping learners with comprehensive language skills. Industry 4.0 fostered a continuous learning approach that allows students to adapt to changes continuously. Industry 5.0 aims to form a rather integrated human-AI toolset encompassing technological proficiency, critical thinking, creativity, and cultural awareness.

This analysis underscores how foreign language education has evolved to align with technological advancements and societal needs, culminating in a model prioritizing human-centered innovation alongside cutting-edge technology in Industry 5.0. To overcome the hurdles generated by Education 5.0, instructors need to implement new approaches that close the technological advances and human-centered paradigms. In the current era, a paradigm shift in pedagogical methodologies is required. This transformation must extend beyond the confines of conventional instructional approaches, encompassing the integration of contemporary technologies while maintaining a foundation in traditional

interpersonal communication and cultural awareness. The parallel development of AI and immersive technologies such as virtual reality (VR) and augmented reality (AR) provides unprecedented potential for individualization and adaptation of learning. However, teachers need to guarantee that these tools are used to support and not override human creativity, human emotions, and the capacity for human critical thinking. School-based, technology-driven interventions that enhance the anthropological component of the educational process can enable learning to progress so that students have the breadth of skills necessary for success in a multi-person, AI-enabled world.

The following strategies outline practical approaches to achieving this progress:

1) Enhancing technological competence. Application-orientated lessons in digital tools, e.g., Grammarly or Duolingo, will enable the student to acquire knowledge about adaptive learning systems.

2) Promoting collaboration through AI integration. Together with AI tools, e.g., Elsa Speak and ChatGPT, collaborative projects can improve language levels.

3) Strengthening interpersonal communication skills. Activities such as role-playing and virtual cross-cultural interactions foster the development of interpersonal communication.

4) Advancing cultural awareness and sensitivity. VR tools, like Google Earth VR, provide engaging cultural experiences leading to global exposure.

5) Fostering critical thinking and creativity. Tasks like app development and digital presentations employ holistic skills and promote creative problem-solving.

Conclusions. The development of foreign language pedagogy, along with the sequential industrial revolutions, has reflected technological innovations coupled with changing societal concerns, reaching a human-AI co-developed paradigm in Industry 5.0. In this context, the role of integrating state-of-the-art technology with human creativity, empathy, and critical thinking is crucial. However, Industry 5.0, while offering unprecedented possibilities for personalization and adaptation in

teaching practice, also poses unique challenges, including how to retain the humanity of teaching and how to close the digital gap.

To address these challenges, teachers must adopt innovative approaches integrating technological skills, interpersonal communication, and cultural knowledge. Foreign language teaching can be leveraged by applying adaptive learning systems, AI collaboration, and interpersonal communication to equip students with the skills necessary to flourish in the technology-driven and humanistic world of the future. The success of education in Industry 5.0 ultimately depends upon a student with a holistic skill set to manage the challenges of an AI-driven era while being aware of the importance of human interaction and creativity.

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**Ivaniuk A.O.**  
**PRESERVATION OF CULTURAL HERITAGE THROUGH  
DIGITIZATION**

*Language Advisor – Lecturer Lukianenko N.M.*

The preservation of cultural heritage is a pressing concern in our rapidly evolving digital landscape. As physical artifacts face threats from environmental degradation, natural disasters, and human conflict, digitization has emerged as a vital strategy for safeguarding cultural legacies. This article explores the significance of digitization in preserving cultural heritage, the technologies involved, its benefits, and the challenges faced in this endeavor.

**The Role of Digitization in Cultural Heritage Preservation.**

Digitization refers to the process of converting physical artifacts, documents, and other forms of cultural heritage into digital formats. This transformation allows for the creation of digital surrogates—virtual representations that can be accessed and interacted with remotely. The importance of digitization lies in its ability to ensure that cultural heritage is not only preserved but also made accessible to a global audience.

**Key Principles of Digitization.**

1. **Empirical Provenance:** It is crucial to maintain a transparent record of the methods used to create digital surrogates. This involves documenting the authenticity and reliability of the digital representations, which is essential for academic research and public trust in these resources.

2. **Perpetual Digital Conservation:** Effective digitization strategies must include plans for long-term storage and preservation. This requires adopting scientific methods that guarantee the availability of digital heritage for future generations.



3. Democratization of Technology: Access to digitized cultural heritage should be equitable, allowing researchers, educators, and the general public to engage with these resources easily. This principle emphasizes the need for user-friendly platforms that facilitate access to digital collections.

#### Technologies Enabling Digitization.

Recent advancements in technology have greatly enhanced the capabilities of digitization efforts:

- 3D Modeling and Scanning: Techniques such as photogrammetry and laser scanning allow for detailed three-dimensional representations of artifacts, providing immersive experiences for users.

- Virtual Reality (VR) and Augmented Reality (AR): These technologies create interactive environments where users can explore cultural sites and artifacts in innovative ways. For instance, virtual tours enable individuals to experience historical locations without physical travel.

- Digital Archiving: The establishment of robust digital archives ensures that cultural materials are stored securely and can be retrieved efficiently. This includes implementing standards for metadata and data management to enhance discoverability.

The digitization of cultural heritage brings numerous advantages:

1. Increased Accessibility: Digital resources can be accessed from anywhere in the world, breaking down geographical barriers and allowing diverse audiences to engage with cultural heritage.

2. Enhanced Preservation: Digital formats protect against physical deterioration caused by time and environmental factors. By creating digital copies, institutions can preserve the essence of artifacts even if the originals are lost or damaged.

3. Promotion of Cultural Awareness: Digitized collections raise awareness about cultural heritage and its significance. Educational programs utilizing these

resources can foster a deeper understanding and appreciation among younger generations.

4. Support for Research: Scholars benefit from easy access to a wealth of information that can be used for academic research, leading to new insights into history, art, and culture.

5. Economic Opportunities: Enhanced access to cultural heritage can stimulate tourism and related industries by attracting visitors interested in virtual experiences or educational programs based on digital content.

Despite its many benefits, digitization faces several challenges:

- Digital Obsolescence: Rapid technological advancements can render certain formats obsolete, risking loss of access to important cultural data if not managed properly.

- Resource Constraints: Many institutions lack the funding or expertise necessary to implement comprehensive digitization projects. This can lead to disparities in access between well-funded institutions and those with limited resources.

- Copyright Issues: Navigating copyright laws can complicate digitization efforts, particularly when dealing with proprietary content or traditional knowledge that may not have clear ownership rights.

Several successful initiatives illustrate the potential of digitization in preserving cultural heritage:

- Europeana: This European digital platform aggregates millions of digitized items from various cultural institutions across Europe, providing a comprehensive resource for researchers and the public alike.

- Vietnam's Heritage Digitization Program: The Vietnamese government has launched initiatives to digitize its tangible and intangible cultural heritage comprehensively. This includes creating digital archives for national treasures recognized by UNESCO.

The digitization of cultural heritage is an essential strategy for preserving our collective history in an increasingly digital world. By leveraging modern technologies and adhering to key principles such as empirical provenance, perpetual conservation, and democratized access, we can ensure that cultural legacies are safeguarded for future generations. While challenges remain, the benefits—ranging from increased accessibility to enhanced preservation—underscore the transformative potential of digitization in enriching our understanding and appreciation of diverse cultures worldwide. As we continue to advance in this field, it is vital that we address these challenges collaboratively to maximize the impact of our efforts on global cultural heritage preservation.

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**Konotop K. O.**  
**THE VITAL ROLE OF HUMANITIES IN SHAPING A BALANCED AND  
PROGRESSIVE SOCIETY**

*Language Advisor – Asst. Prof. Chevychelova O. O.*

Humanities play a pivotal role in shaping modern society by influencing cultural, ethical, and intellectual development. The disciplines within the humanities – such as philosophy, history, linguistics, literature, and art – offer a comprehensive understanding of human behaviour, values, and traditions, providing individuals with the tools to navigate the complexities of the modern world.

The significance of humanities lies in their ability to foster critical thinking, empathy, and creativity. By studying the past, society gains insights into current challenges and potential future directions. Historical analysis, for example, helps individuals and communities understand the roots of social issues, enabling informed decision-making. Understanding the history of conflict, for example, can guide contemporary peacebuilding efforts. Similarly, literature and art encourage individuals to explore diverse perspectives, promoting inclusivity, empathy, and mutual respect – crucial values for fostering social cohesion in an increasingly interconnected world.

In the digital age, as technological advancements reshape every aspect of life, humanities bridge the gap between innovation and human-centric development. While science and technology offer solutions to pressing challenges, the humanities help ensure that these solutions respect human dignity, diversity, and ethical considerations. For instance, philosophical studies in ethics provide guidance on the responsible use of technologies such as artificial intelligence, biotechnology, and robotics, ensuring they are used for the common good rather than exacerbating inequalities or compromising privacy.

The humanities also play an indispensable role in addressing the ethical dilemmas that arise from technological advancements. Fields such as bioethics and environmental ethics examine the moral implications of emerging technologies,

encouraging us to question the boundaries of scientific innovation. As artificial intelligence and genetic engineering evolve, the ethical implications of these technologies demand careful attention. Philosophical discourse, grounded in centuries of ethical reflection, remains a crucial tool for navigating these complex issues. Humanities offer not only frameworks for ethical decision-making but also critical perspectives on the social and cultural impacts of new technologies.

Furthermore, while technological progress often aims to increase efficiency and convenience, it is the humanities that remind us of the broader human experience – helping us consider the emotional, cultural, and existential consequences of innovation. For example, the conversation surrounding AI ethics has benefitted from philosophical and literary contributions, which explore not only the functionality of AI but also the existential questions it raises, such as the nature of consciousness and the role of the human being in an increasingly automated world.

Humanities also contribute significantly to the preservation and promotion of cultural heritage. While modernization brings progress, it can also lead to the erosion of cultural traditions and languages. Humanities disciplines, such as anthropology, sociology, and cultural studies, help document, preserve, and celebrate cultural diversity. By understanding and respecting historical and cultural contexts, societies can avoid the homogenization of global culture and instead foster a rich exchange of traditions that inform both local and global identities.

Moreover, humanities are crucial in addressing global challenges such as climate change, inequality, and political instability. Solutions to these problems must be grounded in ethical reasoning and an understanding of human values. Climate change, for instance, is not only an environmental issue but also a deeply human one, raising questions about justice, responsibility, and intergenerational equity.

Similarly, tackling political instability or social inequality requires a nuanced understanding of power structures, historical grievances, and cultural dynamics.

Interdisciplinary collaboration between the humanities and other fields – such as the natural sciences, economics, and political science – promotes a more comprehensive approach to problem-solving, one that integrates technical innovation with social responsibility and human well-being.

Educational systems worldwide increasingly recognize the importance of integrating the humanities into curricula. This interdisciplinary approach equips students with holistic skill sets that prepare them for diverse professional environments. Employers across industries value the soft skills derived from the humanities, such as effective communication, problem-solving, adaptability, and the ability to think critically. Moreover, studies have shown that individuals trained in humanities demonstrate higher levels of empathy, emotional intelligence, and resilience – traits that are essential for effective leadership in today's complex and globalized world.

The growing emphasis on STEM (Science, Technology, Engineering, and Mathematics) education, while necessary for technological advancement, should not come at the expense of the humanities. Humanities foster the broader perspective necessary for contextualizing technological developments within social, ethical, and cultural frameworks. In an era where technology impacts every facet of human life, the ability to critically assess its consequences, advocate for human rights, and engage in meaningful dialogues across cultures is increasingly indispensable.

Despite their undeniable relevance, humanities face significant challenges, particularly in the context of reduced funding and increasing undervaluation compared to STEM fields. Economic pressures and a focus on short-term practical outcomes often lead to the marginalization of the humanities in educational and research priorities. However, advocates for the humanities emphasize that, far from being a luxury or secondary concern, these disciplines are foundational to creating a society that is not only technologically advanced but also morally grounded and culturally enriched. Many universities and governmental bodies are urged to

reinvest in humanities research, ensuring that these disciplines continue to contribute to societal progress. Advocates argue for a more balanced educational framework, one that acknowledges the importance of technical expertise while also fostering cultural awareness, ethical reasoning, and social responsibility.

In conclusion, the humanities are indispensable for nurturing a balanced and progressive society. Their contributions extend far beyond academic settings, influencing public policy, community development, and individual growth. Whether addressing ethical challenges in technology, preserving cultural heritage, or providing insight into human nature and behaviours, the humanities remain central to fostering a world that prioritizes both innovation and human dignity. As societies continue to evolve in the face of global challenges, the humanities will be essential in ensuring that our advancements remain human-centred, inclusive, and just.

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**Koptiev R.O.**  
**THE EVOLUTION OF LEGAL STANDARDS FOR PROSECUTORS IN A  
DIGITAL AGE**  
*Language Advisor – Lecturer Lukianenko N.M.*

As technology transforms societal norms and expectations, the role of prosecutors becomes increasingly complex. This article examines the evolution of legal standards governing prosecutorial conduct, particularly regarding digital evidence, artificial intelligence, and public scrutiny. Emphasizing the need for modern prosecutors to adapt to these changes, it highlights the principles of justice, fairness, and transparency.

The role of a prosecutor is critical to the criminal justice system, serving as both an advocate for the state and a guardian of the rights of the accused. Recent advancements in technology and heightened public awareness of legal standards necessitate a reevaluation of prosecutorial practices. This paper explores evolving legal standards impacting prosecutors, focusing on digital evidence, artificial intelligence (AI), and public scrutiny.

#### Historical Context

The prosecutorial role has undergone significant changes over the decades. Historically, prosecutors operated within rigid frameworks established by law and tradition. However, the rise of the internet and digital communication has introduced challenges that require reevaluation of existing legal standards.

From Common Law to Statutory Frameworks: The evolution from common law principles to modern statutory frameworks is crucial. Statutes like the Federal Rules of Evidence and the Model Rules of Professional Conduct provided baselines for prosecutorial conduct, but these frameworks are now being challenged by technological realities (Briff, 2008).

Precedent in the Digital Age: Landmark cases, such as *Kyllo v. United States* (2001), addressed the use of new technologies in law enforcement and set important precedents regarding privacy and digital surveillance. As technology continues to evolve, new cases will shape the legal landscape for prosecutors.



## The Impact of Digital Evidence

Digital evidence has become a cornerstone of modern criminal prosecution. Prosecutors must understand the legal standards surrounding the collection, preservation, and presentation of this evidence.

**Chain of Custody:** The integrity of digital evidence is paramount. Prosecutors must ensure that proper protocols are followed to maintain the chain of custody, avoiding challenges that could undermine the admissibility of evidence in court (Walker, 2021).

**Privacy Concerns:** The collection of digital evidence often raises significant privacy issues. The Fourth Amendment protects against unreasonable searches and seizures. As data collection methods evolve, interpretations of these protections must also adapt (McCoy, 2019).

**Emerging Technologies:** Technologies such as blockchain and digital forensics present new opportunities and challenges. Prosecutors need to be equipped with knowledge to understand and utilize these tools effectively while adhering to legal standards.

## Artificial Intelligence in Prosecution

AI technologies are beginning to play a role in various aspects of prosecution, from case management to predictive policing. While these tools offer potential efficiencies, they also raise ethical and legal concerns.

**Bias and Discrimination:** AI algorithms can inadvertently perpetuate biases present in historical data. Prosecutors must be vigilant about the potential for discriminatory outcomes and consider the ethical implications of relying on AI in decision-making processes (McCoy, 2019).

**Transparency and Accountability:** The use of AI in prosecutorial decisions must be transparent. Legal standards should require clear documentation of how AI tools are employed, ensuring that all stakeholders understand the decision-making process.

**Admissibility of AI-Generated Evidence:** As AI systems generate evidence, legal standards governing the admissibility of such evidence must be defined. This includes understanding how AI-generated content is authenticated and assessed for reliability (Walker, 2021).

#### **Public Scrutiny and Prosecutorial Accountability**

The rise of social media and 24-hour news cycles has amplified public scrutiny of prosecutorial actions. This shift demands a new approach to transparency and accountability.

**Ethical Standards:** Modern prosecutors must adhere to stringent ethical standards to maintain public trust and fulfill their duties as officers of the court. The legal community is increasingly focusing on the importance of ethical conduct in light of public perception (Roberts, 2020).

**Community Engagement:** Engaging with the community can enhance transparency and foster trust. Prosecutors should consider outreach initiatives to educate the public about their roles and the challenges they face, demystifying the prosecutorial process.

**Media Relations:** Developing a strategic approach to media relations is crucial. Prosecutors must navigate the balance between providing information to the public and protecting the integrity of ongoing investigations.

#### **Training and Professional Development**

As legal standards evolve, so too must the training and development of prosecutors. Continuous education on technological advancements, ethical considerations, and community relations is essential for modern prosecutors.

**Curriculum Development:** Law schools and professional organizations should develop curricula that reflect the changing landscape of prosecution. Topics such as digital evidence, AI, and community engagement should be integral to legal education (Briff, 2008).

**Ongoing Training Programs:** Prosecutors should engage in ongoing training to stay informed about technological advancements and ethical standards.

Workshops, seminars, and collaborations with tech experts can help ensure that prosecutors are well-equipped to handle modern challenges.

**Mentorship and Support Networks:** Establishing mentorship programs can help newer prosecutors navigate the complexities of their role. Experienced prosecutors can provide guidance on best practices and ethical dilemmas, fostering a culture of continuous learning.

The role of prosecutors is evolving in response to technological advancements, shifting societal norms, and increased public scrutiny. As legal standards continue to change, it is imperative for future prosecutors to adapt and uphold the principles of justice, fairness, and transparency. By embracing ongoing education, engaging with the community, and remaining vigilant about ethical standards, prosecutors can navigate the complexities of their role in a digital age.

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**Lupienos A. O.**  
**ADAPTATION OF ENGLISH FOR FOREIGNERS**  
**IN ENGLISH-SPEAKING COUNTRIES**

*Language Advisor – Asst. Prof. Beztsinna Zh. P.*

Relocating to an English-speaking country can be an exciting yet challenging experience for foreigners, especially when it comes to adapting to the English language. English, with its diverse vocabulary, regional accents, idiomatic expressions, and cultural nuances, can feel overwhelming for non-native speakers. However, the process of adaptation is made easier by strategies that both newcomers and the local communities adopt to bridge the language gap. This article explores how English is adapted for foreigners in English-speaking countries and highlights the tools, methods, and social practices that facilitate this process.

Now I want to talk about simplification of English for easier understanding. In today's globalized world, English serves as a common language for communication among people from diverse linguistic backgrounds. However, for many non-native speakers, understanding and using English effectively can be a significant challenge. To address this, English is often simplified in certain contexts to ensure clear and effective communication. Simplified English is not a separate language but a way of adapting English to make it easier to understand. This adaptation involves using basic vocabulary, straightforward grammar, and avoiding overly complex expressions.

Simplification of English is necessary when communicating with people who are still learning the language or whose proficiency levels vary. It ensures that the message is understood without requiring the listener or reader to struggle with advanced vocabulary, idiomatic expressions, or complex sentence structures. Simplified English is commonly used in international workplaces, educational settings, public services, and even day-to-day conversations in multicultural environments.

1. Basic Vocabulary

Simplified English avoids using advanced or technical words, focusing instead on common, everyday terms. This reduces the cognitive load on the listener or reader and makes the message more accessible. For example, instead of saying, “We need to mitigate the risks associated with this decision”, one might say, “We need to reduce the risks of this decision”.

## 2. Shorter Sentences

Long and complex sentences can be difficult for non-native speakers to process. Simplified English often uses shorter sentences that convey one idea at a time. For instance, instead of saying, “Although the proposal has several benefits, the implementation process might be challenging due to limited resources”, a simplified version would be, “The proposal has benefits, but it might be hard to implement because we lack resources”.

## 3. Avoidance of Idioms and Slang

Idioms and slang are often culturally specific and difficult for non-native speakers to interpret. Simplified English replaces these with more literal expressions. For example, “Don’t beat around the bush” might be replaced with “Please get to the point”.

The next what I want to talk about is one of the most significant challenges foreigners face when adapting to English-speaking countries, which is understanding local dialects and accents. English, as a global language, comes in many regional variations that differ in pronunciation, vocabulary, and even grammar. For instance, the way English is spoken in the United States is different from the English spoken in the United Kingdom, Australia, or South Africa, and within each country, regional accents add another layer of complexity. A newcomer in the United States may encounter vastly different accents, such as the Southern drawl, the New York accent, or the Californian way of speaking. Similarly, someone in the UK might need to distinguish between Received Pronunciation, Cockney, or the Scottish and Welsh accents.

Local dialects also feature slang and idiomatic expressions unique to specific areas. For example, in Australia, phrases like “No worries” or “She’ll be right” are commonplace, but their meaning might not be immediately clear to a foreigner. In the UK, a phrase like “That’s brilliant” often means something is great, while in American English, the same word might describe intelligence.

Exposure to local dialects and accents usually happens naturally through daily activities such as shopping, commuting, or socializing, but it can feel overwhelming at first. To adapt, many foreigners turn to resources like local television shows, radio programs, and podcasts.

It’s important for learners to remember that adapting to local dialects and accents is a gradual process. It requires patience, active listening, and consistent exposure. Over time, as they become accustomed to the rhythm, tone, and unique quirks of the local language, foreigners not only improve their English skills but also gain deeper insight into the culture and people of the region.

Technology has revolutionized language learning, making it more accessible, interactive, and effective for foreigners adapting to English-speaking countries. With a variety of tools and platforms available, learners can tailor their experience to suit their skill level, learning style, and specific goals. From mobile apps to AI-powered tools, technology plays a pivotal role in helping individuals bridge the language gap and integrate more easily into English-speaking environments.

Mobile applications are among the most popular tools for learning English, offering flexible and engaging ways to practice language skills. Apps like Duolingo, Babbel, and Rosetta Stone provide bite-sized lessons that cover vocabulary, grammar, and pronunciation. They are designed for incremental learning, allowing users to make progress at their own pace.

Translation tools are indispensable for foreigners who need immediate help with understanding or expressing themselves in English.

- Google Translate: this versatile app allows users to translate words, phrases, or entire sentences into English from their native language. Features like

real-time text scanning and voice translation make it particularly helpful for navigating daily life.

- DeepL Translator: known for its accuracy, DeepL is a favorite for translating complex or nuanced texts.

AI chatbots have brought innovation to language learning by simulating real-life conversations. Tools like ChatGPT, Replika, and language-specific bots engage learners in dialogue, providing opportunities to practice conversational English in a safe and pressure-free environment. Chatbots can correct grammar, suggest better phrases, and explain errors, helping users improve their spoken and written English. Conversations are often tailored to scenarios like ordering food, making appointments, or casual small talk, preparing learners for real-world interactions.

In conclusion, the adaptation of English for foreigners in English-speaking countries is a multifaceted process that requires both effort from the learners and accommodations from the society. With simplified communication, community support, and modern learning tools, the process can be made less daunting and more enriching. The ultimate goal is not just fluency but also cultural integration, allowing individuals to thrive in their new environments. For foreigners, patience, openness, and consistent practice are the keys to mastering English and feeling at home in an English-speaking country.

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**Lykhman Y. V.**

**PSYCHOLOGICAL CHARACTERISTICS OF PERSONALITY  
RESPONSES TO VIOLATIONS OF PERSONAL BOUNDARIES**

*Scientific Advisor – Cand. Psychol. Sc, Assoc. Prof. Bogdan Zh. B.*

*Language Advisor – Prof. Saienko N.V.*

Individual boundaries play a significant role in a person's life. Whether it is about romantic relationships, friendships, interactions with colleagues, or family connections, a clear understanding of one's own boundaries contributes to a deeper comprehension of one's personality and beliefs while also providing others with insight into these aspects. It is important to note that individual boundaries are not always evident and can present challenges in defining priority aspects. Boundaries can take different forms – mental, emotional, physical, and even digital. Awareness of this helps individuals better navigate their needs and respond appropriately to situations involving personal boundaries.

The first critical step in establishing healthy personal boundaries usually involves understanding which behaviors from others are considered acceptable and which might cause discomfort or tension. Feelings of exhaustion, stress, or resentment after interacting with someone often indicate the need to set boundaries within those relationships. All boundaries that a person sets for themselves should be clearly and understandably communicated to others. Personal boundaries can vary from rigid to flexible, occupy intermediate positions, or even be entirely



absent. A complete lack of boundaries may indicate a weak personal identity or excessive dependence on another person (Chernata, 2024).

Healthy personal boundaries contribute to the formation of individuality. They help individuals clearly define their unique characteristics and outline what they are willing to take responsibility for and what they are not. Such boundaries are a key element of self-care, as the lack of proper boundaries in work or personal relationships often leads to accumulating grievances, anger, and emotional exhaustion (Doel et al., 2010).

Establishing healthy boundaries offers significant benefits, particularly by enabling individuals to make decisions based on their needs rather than solely on the expectations of others. This autonomy is an essential component of self-care, positively influencing overall health and well-being (Gross, & Mueller, 2021).

Mental health professionals consider personal boundaries a key component of harmonious relationships. Clear boundary setting in any interaction allows people to care for their psychological well-being, which is not an expression of selfishness but an important factor in personal welfare.

Balanced personal boundaries can support the development of individuality. They allow individuals to highlight their uniqueness and clearly determine what they are ready to take responsibility for and what they are not. A study was conducted to research the psychological characteristics of personality responses to violations of personal boundaries. According to the study's findings, it was revealed that boundary violations can evoke a wide range of emotional responses, from anxiety and irritation to a loss of self-esteem and confidence. It was found that individuals with well-defined boundaries are better at coping with the stress caused by such situations, demonstrating resilience and the ability to protect their interests.

In addition, it should be noted that healthy individual boundaries play a crucial role in building personal resilience. Such boundaries foster the development of an individual's ability to protect their values, beliefs, and personal space, which are key aspects of self-awareness and self-improvement. They allow people to

avoid situations where they may be exploited or manipulated, providing a sense of personal safety and emotional stability.

In the context of social interaction, boundaries define a comfortable distance that promotes the preservation of personal freedom as well as the building of trust with others. For example, individuals who can appropriately outline their boundaries are more likely to avoid conflicts arising from misunderstandings or excessive demands from others. Such people are able to clearly express their needs and expectations, which is essential for maintaining harmonious relationships.

The study also revealed that boundary violations often lead to psychological discomfort, expressed through emotional reactions such as resentment, aggression, anxiety, or depressive moods. Consequently, this may impact self-esteem, leading to feelings of inadequacy or reduced self-respect. In such cases, psychological support is necessary to restore emotional balance and develop self-defense skills. Therapeutic approaches, particularly cognitive-behavioral therapy, can help individuals establish clearer personal boundaries, understand their own needs, and develop the ability to assertively protect themselves in interactions with others.

Given the above, the ability to establish healthy boundaries not only enhances stress resilience but also enables more effective resolution of life challenges. Mastering boundary-setting skills allows people to retain their identity while balancing personal needs and external environment demands. This is especially important for professional activities, particularly in fields that require constant interaction with others, such as social work, education, psychology, and medicine. In these areas, professional activities are often accompanied by increased emotional stress, and the ability to maintain healthy boundaries allows individuals to avoid burnout and sustain high motivation for work.

The study's findings emphasize the importance of cultivating healthy boundaries from an early age. Educational institutions and families play a pivotal role in helping children develop the ability to clearly express their needs, protect their rights, and recognize signals indicating potential violations of their personal

space. It is important for parents and educators to teach children to respect others' boundaries and model healthy social interactions. It is also noted that the environment in which a child is raised can be decisive in forming their ability to self-identify and accept their own personal boundaries.

Thus, the formation and maintenance of healthy individual boundaries have a multidimensional impact on the personality, from strengthening emotional stability to building effective and harmonious relationships with others. This skill is fundamental to personal growth, supports adaptability in various social contexts, and promotes psychological well-being.

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## **Mohnatkina A. O** **CURRENT PROBLEMS OF ORAL, WRITING, INDUSTRIAL,** **ARTISTIC TRANSLATION**

*Language Advisor Asst. Prof. Vorobyova S.V.*

Changes in the model of modern education and science have an impact on the social need in the field of translation, making new demands to train future translators. If we consider the modern role that Ukraine plays in the world context, the demand for qualified interpreters is growing very quickly. But the method of

teaching oral translation is still only at the stage of formation, it is only partially a methodology, and has special features of the general theory of learning, it can often be considered as applied translation studies, as well as an element of the methodology of teaching foreign languages. Following the international patterns of training of interpretation specialists, attention is paid to the cycles of professional training of translators, for example – translation at conferences, translation in court, translation in the field of health care, public services, which improves the methodology of teaching interpretation. Therefore, the training of future translators does not fully meet social needs.

In most cases, the teaching methodology of interpreting in leading countries is based on national professional standards developed by organizations, as they have a clear list of requirements and components of translation competence. The most classic is the training of interpreters on the basis of General Philological Education, which is based on mastering the skills of oral translation.

The need for translation increases every year, therefore, speaking of written translation, the search for rational ways to solve the difficulties of fast and large-scale translation is relevant today. Automated translation can solve this problem. In automatic systems, the machine can make errors of various types, but the text remains clear. Today's computer translation programs can be successfully used, but you should check the text, paying special attention to the translation of proper names, terms, the peculiarities of controlling verbs, words in an indirect meaning and polysemous paronyms, homonyms, grammatical forms, etc. The general theory of translation is based on the data obtained when observing the object in its various manifestations. These manifestations can be random, atypical, so they are not taken into account. These manifestations can be repeated, be typical, in which case the theory considers them to be regular in general or for one or another type of translation separately. For a long time, there was no doubt that interlanguage transformations can be carried out only by humans. Scientific and technical progress in the twentieth century made this a significant clarification:

interlanguage transformations can be performed by both a person and a machine. This became the first basis for the classification of translation: the mechanisms of interlanguage transformations. On this basis, the theory of machine translation was launched.

In a written translation, the theoretical aspect of the translator's work is in the first place, to correctly analyze and choose language means, to preserve the style of the original. Therefore, the written translation of fiction is very different from the translation of other types of texts, because the language of artistic works is characterized by figurative means, the rhythm of the language, and the individual style of the author. The transfer of figurative means of language, stylistic features of the writer depends to a greater extent on the literary talent of the translator, on his feeling for the language, than on the automatic skills developed by him.

Linguistic means determine the genre character of texts, which is the basis for the classification of written translation and determines the legality of distinguishing the theory of artistic translation and the theory of special translation.

The peculiarities of the translation of a scientific text lie in terms and facts, so you need to be prepared for the translation of this genre. The success of a translator's work in the scientific field is determined more by his knowledge and ability to operate with terminology than by translation skills.

The problem of translation is one of the most important and brightest in the intercultural aspect of translation. Translation acts as a kind of means of protection of national languages and cultures, which preserves them from the excessive influence of foreign cultures, but at the same time is the driving force of their self-development. The result of the translator's activity is the merging of various cultures of the original and the translation, which contributes to the mutual enrichment of the two languages.

In the world, the objective and natural necessity of introducing the language of international communication has come. Among politicians and linguists, there is an ongoing debate about the question of which language can

perform this function. Most believe that it is English. Nowadays, the language continues to spread around the world, fragmenting into local dialects.

The incommensurability of the categories of different cultures, which in particular results in differences in meanings, can lead to the impossibility of translation. This occurs when the same object-stimulus is often categorized differently depending on the cultural dependence. Understanding in intercultural contact is regulated by certain conditions, which impose certain restrictions on the flow of the communicative process. Therefore, there is ethnopsycholinguistics, which is a discipline on the border of psycholinguistics, ethnolinguistics and ethnology, the object of which is ethnic consciousness and its reflection in language and speech activity.

So, in the end, we must say that translation is a very important and necessary means of intercultural communication. It is extremely important for maintaining direct connections between communicators of different linguistic and cultural areas. The translator has an important role in maintaining various contacts with the world on a daily basis. The translator must be familiar with the main cultural characteristics of the country of the translation language and have certain background knowledge. The main problems that a translator may have to deal with are establishing a cultural connection between speakers and overcoming the language barrier.

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**Nikiforova S.M., Hasanenko L.O.**  
**ENGLISH IDIOMS THAT REFLECT CULTURAL VALUES**

*Language Advisor – Asst. Prof. Nikiforova S. M*

### Introduction

Idioms are an essential part of language, offering expressions that go beyond the literal meaning of words. They play a crucial role in shaping and conveying cultural values, beliefs, and norms. In English, idioms provide insight into how people perceive their world, what they prioritize, and how they interact with one another. Through idioms, we gain a window into the societal values that drive individual behavior and community life. By understanding idioms, one can appreciate how language acts as a cultural mirror, reflecting the social fabric of the community. This work will explore various English idioms that reflect core cultural values, such as individualism, hard work, respect for others, community, and tradition. It will also discuss how these idioms adapt to the changing cultural landscape in the modern world.

#### 1. The Role of Idioms in Culture

Language is not merely a tool for communication but also a reflection of the underlying cultural values of a society. Idioms, in particular, serve as a cultural artifact, preserving and transmitting these values over time. Since idioms often have figurative meanings that go beyond their literal interpretation, they provide a deeper understanding of the beliefs, attitudes, and historical experiences of the people who use them.

For instance, idioms related to nature often reflect how societies interact with the environment. In English, idioms like "a leopard can't change its spots" or "don't count your chickens before they hatch" emphasize certain aspects of human behavior and predictability. They represent long-standing cultural ideas about human nature, the inevitability of certain outcomes, or the importance of being cautious and patient. Such expressions mirror the ways in which societies view human behavior, fate, and personal responsibility.

Furthermore, idioms also convey societal norms and expectations. Whether they express respect for authority, the importance of hard work, or the value of personal integrity, idioms often act as both tools of socialization and moral education. In essence, idioms help individuals understand how to behave in a way that is consistent with societal standards.

## 2. English Idioms Reflecting Core Cultural Values

### Individualism and Independence

The English-speaking world places a strong emphasis on individualism and independence. Idioms such as "pull yourself up by your bootstraps" highlight the cultural value of self-reliance, suggesting that personal effort is key to overcoming challenges. Another idiom, "every man for himself," reflects the idea of personal survival, particularly in competitive or challenging situations. Similarly, "break the ice" reflects the importance of overcoming social awkwardness through individual initiative.

### Hard Work and Success

Hard work is deeply valued in English-speaking cultures, as seen in idioms like "the early bird catches the worm," which stresses the importance of being proactive and diligent. Another idiom, "no pain, no gain," underscores the belief that success is only achieved through hard work and perseverance.

### Politeness and Respect for Others

English-speaking societies also prioritize politeness and respect for others. The idiom "mind your P's and Q's" encourages good manners and social decorum. Similarly, "the customer is always right" reflects the cultural value of mutual respect in business transactions, emphasizing the importance of customer satisfaction and service.

### Community and Cooperation

While individualism is highly regarded, community and cooperation are also essential values. The idiom "it takes a village" emphasizes the importance of collective effort, particularly in areas like child-rearing and personal growth.



"Many hands make light work" highlights the value of teamwork, suggesting that cooperation makes tasks easier and more efficient.

### Tradition and Heritage

English idioms often reflect respect for tradition. "A stitch in time saves nine" promotes the idea of addressing problems early to avoid bigger issues later, underscoring the value of foresight and maintaining traditions. Similarly, "what goes around comes around" reflects the belief in karma and justice, emphasizing that actions have consequences.

### 3. Idioms in Context: Influence of Modern Times

In today's rapidly changing world, idioms are not static. They evolve with cultural shifts, technological advancements, and global interconnectedness. As the world becomes more digital and interconnected, new idioms are emerging that reflect modern concerns and realities.

For example, idioms like "Google it" or "clickbait" are products of the digital age, demonstrating how language adapts to reflect new technologies and social behaviors. These idioms show how English-speaking cultures have adapted their language to reflect the influence of technology and the internet, focusing on issues such as information seeking and digital media consumption.

Moreover, globalization has led to an exchange of idiomatic expressions across cultures. As English becomes a global lingua franca, idioms are spreading and being adopted by non-English speakers. This process leads to the creation of hybrid idioms or adaptations of traditional expressions that blend elements from different languages and cultures.

### 4. Conclusion

Idioms are a reflection of cultural values, encapsulating the norms, beliefs, and historical experiences of a society. They serve as a cultural mirror, offering insight into the priorities of a community and the ways in which individuals interact with one another. From emphasizing individualism and hard work to highlighting the importance of politeness and cooperation, idioms provide a glimpse into the

core values that shape English-speaking societies. As the world changes, idioms evolve to reflect new cultural realities, and their adaptability ensures that they remain a powerful tool for expressing cultural identity. Understanding idioms allows us not only to learn a language but also to appreciate the values and traditions that shape it.

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## Schtscherbyna D.I.

### ENTWICKLUNG DES STEUERSYSTEMS DER UKRAINE

*Sprachwissenschaftlicher Leiter – Kand. techn. W., Doz. Ratschkowskij A. W.*

Das Steuersystem der Ukraine basiert auf den Prinzipien, die auf der Grundlage der allgemeinen Steuergrundsätze entwickelt werden, die durch Fiskaltheorie und Fiskalpraxis geschaffen wurden. Das System der Steuern und Gebühren in der Ukraine wird ausschließlich durch die Gesetze der Ukraine festgelegt. Aus der Geschichte ist es bekannt, der Gründer der Steuertheorie ist der schottische Ökonom und Philosoph Adam Smith (1723-1790). Die von ihm vorgeschlagenen Grundsätze bilden die theoretische Grundlage für die Bildung

moderner Steuersysteme. Die Theorie von Smith ist ein ganzheitliches Einstellungssystem, in dem wirtschaftliche Begriffe, Sätze und Schlussfolgerungen normalerweise miteinander verbunden sind. Die von Adam Smith vorgeschlagenen Steuergrundsätze sind auch keine Ausnahme. Sie stützen sich auf seinem Konzept der Gleichwertigkeit verschiedener Arbeitsarten, der Vorschrift über die Rolle des Staates als "Nachtwächter" und nicht als Regulator wirtschaftlicher Prozesse (Грабовський, 2016, с. 11).

Der Staat muss über die notwendigen Mittel verfügen, um seine Funktionen erfüllen zu können: Justiz, Verteidigung und Erbringung bestimmter Arten öffentlicher Dienstleistungen (z. B. Straßenverlegung und -reparatur, die Schaffung des Bildungs- und Erziehungssystems).

In der Entwicklung des Steuersystems der Ukraine gibt es heute vier Zustandsformen. Die erste Phase dauerte von 1992 bis 1993. Es war der Beginn der Bildung des eigenen Steuersystems in der Ukraine und war von großen Diskussionen über die weiteren Entwicklungsperspektiven geprägt (Бачинська, 2019).

Die zweite Phase der Entwicklung des Steuersystems (1994-1999) ist dadurch gekennzeichnet, dass das Steuersystem an die Bedingungen der Marktbeziehungen angepasst wird. Gleichzeitig hatte die Verabschiedung der ukrainischen Verfassung im Jahr 1996, die die tatsächliche Existenz des Steuersystems im Land festigte, erhebliche Auswirkungen auf die Vervollkommenung des Steuersystems.

In der dritten Phase, die im Jahre 2000 begann und bis 2009 andauerte, wurden die Änderungen an einer Reihe der Gesetzgebungsakten berichtigt, um das Steuersystem in der Ukraine zu verbessern. Die wichtigsten Faktoren für die Verbesserung waren die Verringerung der Steuerbelastung für Produzenten und Unternehmer sowie die Einführung stabilerer Standards für die Besteuerung des persönlichen Einkommens, um das Interesse der Bevölkerung für die freiwillige Steuern und Gebühren zu erhöhen (Слугоцька, 2021).

Die vierte Phase der Bildung und Entwicklung des Steuersystems der Ukraine begann 2010 und dauert bis heute an. Es zeichnet sich durch aktive Maßnahmen zur Erstellung und Verabschiedung der Steuergesetzgebung aus. Im Verlauf der Entwicklung der Steuergesetzgebung kam es zu starken Widersprüchen zwischen verschiedenen gesellschaftlichen und wirtschaftlichen Kreisen, die an einem solchen Dokument interessiert waren oder nicht. Am 18. Juni 2010 wurde die Steuergesetzgebung vom ukrainischen Präsidenten verabschiedet und unterzeichnet. Um die Folgen der politischen und wirtschaftlichen Krise von 2014 bis 2015 Jahren zu überwinden wurde in der Ukraine die Steuerreform eingeleitet. Gemäß dieser Reform wurde die Anzahl der Steuern und Gebühren von 22 auf 9 gesenkt. Die staatlichen Steuern umfassen die Körperschaftsteuer, die Verbrauchsteuer, die Umweltsteuer, die Rentenzahlungen und die Gebühren. Die örtlichen Steuern beinhalten die Vermögenssteuer und die Einheitssteuer. Darüber hinaus wurde vorgeschlagen, vorübergehend einige zusätzliche Gebühren zu behalten, einschließlich der Militärsteuer, die ausnahmslos auf alle Einkommen erhoben wird, die der Besteuerung von natürlichen und juristischen Personen unterliegen. Die Reform sieht auch eine Harmonisierung der Buchhaltung und der Besteuerung vor. Eine solche "Harmonisierung" bedeutet, den Steuerbeamten die Möglichkeit zu geben, die Genauigkeit der Rechnungslegung in den Unternehmen zu kontrollieren.

Der Staat soll mit dem Einkommen klug umgehen und die derzeitige rigide Regulierung der Wirtschaft aufgeben, wodurch der Unternehmer in einen "Schatten" gerät. Mit anderen Worten, es ist notwendig, ein Gleichgewicht zwischen den Interessen des Budgets und dem jeweiligen Unternehmer zu erreichen.

Es ist bekannt, dass man kein ideales Steuersystem für ein paar Jahre schaffen kann. Zunächst muss man jedoch über das Finanzsystem der Übergangszeit nachdenken. Das von der Wirtschaft isolierte Steuersystem kann nicht existieren. Mit der Stärkung der ukrainischen Wirtschaft wird sich auch das

Steuersystem verbessern. Gleichzeitig sollten die Steuern die wirtschaftliche Entwicklung nicht behindern, sondern im Gegenteil stimulieren.

Zu diesem Zweck muss die Flexibilität des Steuersystems sichergestellt und an externe und interne wirtschaftliche Bedingungen angepasst werden. Zu diesem Zweck muss die Flexibilität des Steuersystems sichergestellt und an externe und interne wirtschaftliche Bedingungen angepasst werden. Zunächst geht es um die Delegation der Steuerbehörden des Anspruchs auf die Stundungen und Ratenzahlungspläne für die Zahlung von Steuern, auf das Sammeln von Geldbußen und die Verhängung von Geldbußen je nach Finanzlage. Mit diesem Schema kann man das bereits getestete System der Steuergutschriften verwenden.

Das Konzept der Steuerreform umfasst nicht nur die Änderungen in der Gesetzgebung über den Umfang und Ablauf der Steuererhebung, sondern auch die Modernisierung der Steuerdienstleistung sowie deren Anpassung zu bereits bestehenden Marktinnovationen, die die Einnahmen in ausreichender Maße in das Budget sicherstellen könnten.

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**Sierykh D. S.**  
**FOSTERING ACADEMIC INTEGRITY IN LANGUAGE LEARNING:  
THE CRUCIAL ROLE OF SCAFFOLDING FOR UNIVERSITY  
STUDENTS**

*Scientific advisor PhD (Philology), Assistant Professor Ahibalova Tetiana*

Introduction. In the context of higher education, academic integrity is a foundational principle that influences the character and credibility of future professionals. As students progress through their educational pursuits, they are expected to not only acquire knowledge but also uphold values such as honesty, fairness, and respect in their scholarly activities. The ability to communicate effectively, particularly in English, has become crucial due to the global nature of information dissemination. However, the challenges associated with mastering a foreign language can sometimes lead students to compromise their integrity through practices like plagiarism. To address these challenges, scaffolding emerges as a powerful educational strategy that provides structured support tailored to individual learning needs. By breaking down complex tasks into manageable steps and offering guidance throughout the learning process, scaffolding equips students with the confidence and skills necessary to express their ideas authentically.

Purpose. This article explores how participants in the education process can proactively contribute to academic integrity when instructors implement a scaffolding approach in language learning. The paper underscores the efficacy of systematic support in enhancing students' linguistic capabilities and empowering them to navigate their academic obligations ethically, thereby cultivating a culture of ethical academic practice.

The outline of the main research material. The contemporary discourse surrounding higher education increasingly emphasizes the significance of academic integrity in preparing future professionals. Graduates are expected to possess a robust knowledge base, practical experience, and the ability to develop expertise through constant engagement with global information sources. Proficiency in English has become essential across various fields, such as business, medicine,

education, and technology, as much of the most current and reliable data is predominantly available in this language. Consequently, achieving competency in English is a cornerstone of educational excellence (Yeh, 2021). However, mastering a foreign language presents challenges, particularly in upholding academic integrity. Academic integrity embodies principles such as honesty, fairness, respect, and responsibility, which must be embraced by students, educators, and researchers alike (Hyland, 2001). Scaffolding, a pedagogical approach that provides students with the necessary support to achieve specific learning objectives, is pivotal in fostering these values and reducing instances of academic misconduct, such as plagiarism (Rivera, 2010).

Plagiarism and the need for scaffolding underscore the necessity of systematic support in fostering students' development of the competencies and self-assurance necessary to articulate their ideas authentically and ethically in their academic work. Plagiarism, a pervasive form of academic dishonesty, frequently emerges from various factors, including ambiguous educational objectives, inaccurate self-assessment, and psychological impediments. The advent of technology has made plagiarism more convenient. Still, it has also led to a situation where students may lack the skills to articulate their ideas effectively in a foreign language (Ouellette, 2008). Scaffolding addresses these challenges by offering structured and incremental support tailored to each learner's needs. This pedagogical approach has been shown to facilitate the development of both language and cognitive skills while concurrently mitigating the psychological discomfort frequently associated with spontaneously expressing thoughts in a foreign language (Ball et al., 2019).

Scaffolding has effectively reduced psychological barriers by providing learners with structured support that alleviates anxiety and builds confidence, enabling them to engage more fully in the learning process without fear of failure or ridicule. Students frequently struggle with inadequate vocabulary or a reluctance to communicate in a foreign language; research indicates that linguistic challenges

differ across disciplines and proficiency levels. Non-linguistic majors often cite insufficient vocabulary as a barrier, while advanced learners in language-focused programs face more nuanced difficulties (Gee, 2007). Scaffolding provides a supportive framework that encourages students to engage in learning without fear of failure. For instance, scaffolding can involve breaking tasks into smaller, manageable steps, offering clear guidelines, and providing constructive feedback. These strategies have been used to foster students' confidence and competence, enabling them to approach assignments with integrity rather than resorting to plagiarism (Walqui, 2006).

The practical implementation of scaffolding in language learning is crucial for developing essential competencies that enable students to acquire language skills progressively. This approach not only enhances linguistic proficiency but also fosters critical thinking and problem-solving abilities, which are vital in today's globalized world. The key competencies involved in scaffolding include knowledge-based competence, comprehension skills, application skills, analytical skills, synthesis skills, and evaluative competence.

Knowledge-based competence serves as the foundation for language learning. It entails fostering students' ability to draw upon their existing knowledge while systematically introducing new concepts, thereby facilitating the establishment of connections between their prior knowledge and the latest ideas. This process enhances students' comprehension and retention of information. To illustrate, when students build on their prior vocabulary in a new context, they are more likely to recall and apply it effectively.

In the context of scaffolding, cultivating comprehension skills assumes equal importance. Educators take a facilitative role, guiding learners through tasks that necessitate the processes of categorization, summarization, or comparison, thereby enhancing comprehension. Students' engagement in activities that promote active reading and listening enables educators to develop students' ability to extract key ideas and themes from texts or conversations. This skill is essential for effective



communication and comprehension in any language. Application skills center on engaging students in activities that allow them to apply their knowledge in practical contexts. These activities may include role-playing exercises, real-world problem-solving scenarios, or collaborative projects where students must utilize their language skills to communicate effectively with peers. Such activities not only reinforce learning but also cultivate confidence as students recognize the relevance of their language skills in everyday situations.

Analytical skills play a pivotal role in scaffolding by aiding students in recognizing patterns and relationships within complex information. For instance, when analyzing texts or discussing literary themes, learners can cultivate critical thinking skills to interpret meaning beyond surface-level understanding. This analytical approach fosters deeper engagement with the material and develops a more nuanced appreciation of language use. Synthesis skills are promoted through collaborative tasks that require students to generate hypotheses or solutions based on their understanding of the material. Collaborative tasks foster the integration of diverse perspectives and insights, leading to more comprehensive outcomes and a stronger sense of community within the classroom.

Finally, evaluative competence is imperative for students' instruction in formulating informed judgments based on established criteria. This process entails the guidance of learners in the critical assessment of their work as well as that of their peers. Through the cultivation of this competency, students evolve into more reflective practitioners, capable of identifying areas for improvement and establishing objectives for their sustained language development.

Ultimately, cultivating a culture rooted in respect for intellectual property not only enhances individual learning outcomes but also strengthens institutional credibility overall. As future professionals enter various fields equipped with strong foundations built upon principles firmly within academic integrity frameworks, they will carry these values into their careers beyond graduation, ensuring lasting impacts on society while honoring contributions made by scholars before them. By

embracing this collective responsibility towards fostering an environment conducive to ethical practices, students pave pathways leading towards success not just academically but professionally too! This format delineates the introduction, purpose, main material presentation, and conclusions while maintaining continuity throughout the text.

Conclusions. The scaffolding approach in language learning is a multifaceted strategy furnishing students with essential competencies, representing a critical pedagogical methodology in pursuing academic integrity and educational excellence. By providing structured support for students, educators can help them overcome linguistic and psychological barriers while reducing the likelihood of plagiarism. By emphasizing knowledge-based competence, comprehension skills, application skills, analytical skills, synthesis skills, and evaluative competence, educators can cultivate a conducive learning environment that fosters linguistic proficiency and critical thinking abilities, indispensable for success in today's interconnected world.

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**Sokolova A. O.**

**EMOTIONS AND EXPERIENCES OF INDIVIDUALS DURING WAR: A  
PSYCHOLOGICAL PERSPECTIVE**

*Language Advisor – Asst. Prof. Nikiforova S. M.*

### Introduction

War is an extremely complex and traumatic event that leaves a deep and lasting mark on the human psyche. It evokes a wide range of emotions and experiences that individuals may struggle to cope with, varying greatly depending on individual characteristics, experiences, and circumstances.

### Purpose of the Study

The purpose of this study is to analyze the emotional and psychological reactions of individuals to war, to identify individual patterns in these reactions, and to develop recommendations for psychologists, support services, and professionals working with affected individuals.

### Research Objectives

#### 1. Analysis of Emotional Reactions

For over two years, Ukrainians have been living with constant fear and anxiety for themselves and their loved ones. These feelings are amplified by loud noises, sounds of shelling, air raid sirens, and artillery fire. This activates our "fight, freeze, or flight" response.

Reactions can be divided into two branches: the sympathetic system, responsible for "fight or flight," and the parasympathetic system, responsible for

"slow down and freeze." Both systems are designed to maintain balance during stress and normalize the state. However, war changes our perception of the world, and our emotions also undergo significant changes or simply turn off in a stressful situation. This is a natural reaction of the body to function effectively in survival conditions.

During wartime, the brain begins to operate in survival mode. Thus, when a person is constantly in danger, the amygdala, the part of the brain responsible for emotions, is constantly active. It releases adrenaline, thereby preparing the body for "fight or flight." However, when the threat is overwhelming, the brain freezes to conserve energy (heart rate and other physiological reactions slow down).

## 2. Research on Cognitive Processes

Many people experience a decline in cognitive abilities during war. This is not just a perception of their knowledge, but also objective indicators: a decrease in the ability to memorize and reproduce information, difficulty concentrating on one subject or task for more than two to three minutes, or the simplest mistakes that a person did not make before, which indicates a decrease in cognitive abilities.

Why do so many people, both those at the front and those living far from constant shelling or even abroad, have such a reaction? Olga Maslova believes that the reason is that all of us have a "brain at war."

"Of course, differently, of course, with many individual characteristics and differences depending on the security situation around. But - the impact is on everyone, so I consider it correct to use the term 'fog of war' not only to assess the state of combatants, but also for all of us. You can find many articles about the consequences of wars in Vietnam and the Persian Gulf, for example. But we have differences in the state of a relative of a combatant who went to fight as part of some mission, and the state of a relative of a combatant who is in the same country and thinks every day, without exaggeration, about the threats to the

existence of this country. This level of psychological stress is colossal and cannot but affect cognitive abilities," says the biologist [2].

### 3. Analysis of Behavioral Reactions

Behavioral reactions during wartime are extremely diverse and depend on various circumstances and factors (individual characteristics, duration and severity of the conflict, social environment). However, there are certain patterns in behavior that can be identified.

1. Stress reaction - this reaction is characterized by physiological changes (accelerated heart rate, sleep disturbances, headaches), emotional changes (fear, anxiety, anger, loss of control). Behavioral reaction in a stressful situation manifests itself in impulsivity, problems with concentration and aggression.

2. Post-traumatic stress disorder (PTSD) - it is characterized by repeated experiencing of a traumatic event in the form of flashbacks, increased anxiety, aggression, and sleep problems.

3. Depression - a person in this state feels sadness, hopelessness, loss of interest in life, physical changes (changes in appetite and weight), fatigue and decreased energy.

4. Aggressive behavior - a person in such a state directs physical aggression at themselves or others, increases verbal aggression and impulsivity of actions.

### 4. Identification of Risk Factors

Risk factors are certain circumstances that can increase the likelihood of certain psychological problems or trauma. Understanding and identifying these factors is extremely important for the timely identification of people who may need additional support.

Such factors can be divided into three general groups:

1. Traumatic experience: previously experienced traumatic events can increase the risk of developing PTSD.

2. Previous mental disorders: People who have been diagnosed with mental disorders are more vulnerable to their exacerbation during wartime.

3. Personality traits: people with low self-esteem, a pessimistic outlook on life, or difficulty controlling emotions may be more susceptible to negative thoughts. Which over time can lead to negative consequences and the development of various mental diagnoses.

#### 5. Development of Recommendations

The work of a psychologist or support service during wartime is extremely important and complex. Providing effective assistance to victims is a long and difficult process of understanding the psychological processes occurring in wartime conditions.

The main areas of work are: assessment of a person's psychological state, providing emotional support, informing about resources and opportunities to get help, ensuring safety and basic needs.

Recommendations for a psychologist: self-care, empathy and unconditional acceptance, individual approach, cooperation with other specialists.

#### Methodology

In order to always know what can change in emotions or in a person's perception during a war, specialists need to conduct surveys, take interviews, analyze scientific literature, and conduct psychological tests. These methods do not provide a 100% guarantee but are an impetus for finding more and more effective solutions to help people during this difficult time.

#### Conclusion

The study of emotional and psychological manifestations or experiences of a person during wartime is an important and, unfortunately, relevant task of modern psychology. Understanding these processes will allow us to effectively provide assistance to victims and change their perception for the better. Thank you for being there during this difficult time.

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**Tkachenko O.V.**

### **DER EINSATZ VON PROJEKTARBEIT IM FREMDSPRACHENUNTERRICHT**

*Deutschlehrer an der Abteilung für ausländische Philologie, Kommunale  
Einrichtung „Kharkiv Humanitarian“, Pädagogische Akademie“ des Regionalrats  
Charkiw*

Die Recherche nach neuen Organisationsarten und -weisen der Lehrtätigkeit steht schon lange hinter den Aufgaben der modernen Ausbildung. Deshalb wird die Arbeit der Studierenden in solcher Form der Projektarbeit als WebQuest Abwechslung in den Lehrprozess bringen. Und die erhaltene Erfahrung wird die

Ergebnisse in der Zukunft erzielen, weil sich eine Menge der Kompetenzen bei der Arbeit an diesem Projekt entwickelt wird:

- die Nutzung der EDV für die Lösung der professionellen Aufgaben (für die Recherche der notwendigen Informationen, für die Gestaltung der Ergebnisse der Arbeit in Form einer Präsentation, einer Webseite, eines flesh-Werbefilms usw.);
- das Selbststudium und die Selbstorganisation;
- die Arbeit in Team (Planung, Verteilung der Funktionen, gegenseitige Hilfe und Kontrolle);
- die Fähigkeit die Lösungen der Problemsituation auf verschiedenen Weisen zu finden, die günstigste Variante zu bestimmen, die Auswahl zu begründen;
- die Fertigkeit der öffentlichen Aktionen (es ist obligatorisch die Präsentation der Projekte mit den Aktionen der Autoren mit den Fragen und Diskussionen durchzuführen). (Moser, 2000)

WebQuest im Fremdsprachenunterricht ist eine Webseite im Internet, mit der die Lernenden arbeiten, diese oder jene Lehraufgabe erfüllen. Solche WebQuests dienen zur maximalen Integration des Internets in verschiedene Lehrfächer auf verschiedenen Niveaus der Ausbildung. Sie erfassen das abgesonderte Problem, das Lehrfach, das Thema, sie können auch interdisziplinär sein. Man unterscheidet zwei Typen von WebQuests: für kurzfristige Arbeit (das Ziel: die Vertiefung der Kenntnisse und ihre Integration, sie sind für ein paar Doppelstunden) und für langfristige Arbeit (das Ziel: die Vertiefung und die Umgestaltung der Kenntnisse der Lernenden, sie sind auf lange Sicht gerechnet, kann sein, auf das Semester oder das Studienjahr). Die Besonderheit von WebQuests im Unterricht ist, dass sich ein Teil oder die ganze Information für die Eigen- oder Gruppenarbeit der Lernenden auf verschiedenen Webseiten befindet. Außerdem ist das Ergebnis der Arbeit am WebQuest die Entwicklung einer Publikation in Form einer Web-Seite oder Website (lokal oder im Internet). (Rösler, Tschirner 2009).



Ein WebQuest sollte mindestens die folgenden sechs Elemente enthalten:

**Einleitung.** Zu Beginn werden die Lernenden in ein Thema eingeführt. Hier empfiehlt sich eine konkrete und für die Studierenden authentische Problemsituation, die beispielsweise anhand von Videos, Skizzen oder einer kleinen Geschichte dargestellt werden kann und die Studierenden idealerweise dazu motiviert, sich aus eigenem Interesse der Thematik zu widmen.

**Aufgabe.** Die Aufgabenstellung ist das didaktisch zentrale Element eines WebQuests. Unter der Aufgabenstellung wird dabei immer mehr als die Nennung eines Themas verstanden. Zu einem ausgearbeiteten WebQuest gehört die Beschreibung einer möglichst authentischen Situation. Die Komplexität der Aufgabenstellung hängt von der Thematik, vor allem aber von der Zielgruppe ab. Es besteht die Möglichkeit, die Aufgabenstellung mit der Gruppe zu diskutieren und zu verändern oder zu ergänzen

**Materialien.** Für die Bearbeitung der Aufgabe wird den Studierenden eine Auswahl an Internetressourcen in Form konkreter Hyperlinks zur Verfügung gestellt. Diese dient jedoch lediglich als Orientierungshilfe, da die Lernenden auch eigene Rechercheaktivitäten entfalten und die dabei gewonnenen Quellen in ihre Bearbeitung einbeziehen sollen. Neben dem Internet können und sollen Fachbücher und Lexika ebenso als Quellen herangezogen werden wie Zeitungsartikel oder CD-, DVD-ROMs.

**Arbeitsprozess.** Eine anschließende Prozessbeschreibung soll den Studierenden Hilfestellungen hinsichtlich der Arbeitsorganisation geben. Hier werden Vorschläge gemacht für die einzelnen Arbeitsschritte, die Aufteilung der Gesamtaufgabe in einzelne Teilaufgaben oder grundsätzliche Regeln, die bei Gruppenarbeiten beachtet werden müssen.

**Präsentation.** Alle Gruppen sollen ihre Lösungen in adäquater Form (z. B. als Website oder PowerPoint-Präsentation) präsentieren. Deshalb folgen der Beschreibung der Arbeitsphase Angaben zu der von der Lehrkraft gewünschten Präsentationsform.

Evaluation. Abschließend sollte jedes WebQuest evaluiert werden. Einerseits wird den Studierenden hier die Möglichkeit gegeben, eine Reflexion ihres eigenen Lernverhaltens durchzuführen sowie den Lehrkräften Hinweise zur Verbesserung der Vorbereitung und Durchführung von WebQuests zu geben. Andererseits erhalten die Studierenden aber auch ein Feedback seitens der Lehrkraft. (Moser, 2000)

Die Arbeitsphasen der Projektarbeit im Unterricht.

Die Anfangsphase.

Die Studierenden lernen die Hauptbegriffe vom gewählten Thema, die Materialien der ähnlichen Projekte kennen. Dann werden die Rollen in der Gruppe verteilt: 1-4 Menschen auf 1 Rolle. Alle Mitglieder des Teams sollen einander helfen.

Die Rollenphase.

Die Eigenarbeit in der Gruppe beeinflusst das gemeinsame Ergebnis. Die Teilnehmer erfüllen die Aufgaben gleichzeitig entsprechend den gewählten Rollen. Da das Ziel der Projektarbeit keine Konkurrenz ist, so geschieht im Laufe der Arbeit an einem WebQuest die gegenseitige Ausbildung der Mitglieder einer Gruppe. Das Team zieht das Fazit der Erfüllung jeder Aufgabe gemeinsam, die Teilnehmer tauschen die Materialien für die Errungenschaft des gemeinsamen Ziels um.

Die Aufgaben.

- 1) die Suche der Information zum konkreten Thema;
- 2) die Entwicklung der Struktur der Webseite / der PowerPoint-Präsentation etc.;
- 3) die Erstellung der Materialien für die Webseite / die PowerPoint-Präsentation;
- 4) die Fertigstellung der Materialien für die Webseite / die PowerPoint-Präsentation.

Die Endphase.

Die Gruppe arbeitet gemeinsam unter Leitung des Lehrers. Als Ergebnis werden die Schlussfolgerungen gezogen und die Vorschläge abgefasst. In der Endphase kann ein Wettbewerb der erfüllten Aufgaben vorgeschlagen werden, wo das Verständnis der Aufgabe, die Glaubwürdigkeit der verwendeten Informationen, ihre Beziehung zum gegebenen Thema, die kritische Analyse, die Folgerichtigkeit, die Strukturiertheit der Informationen, die Bestimmtheit der Positionen, das Herangehen an die Lösung des Problems, die Individualität bewertet werden. An der Einschätzung der Ergebnisse nehmen wie die Lehrer, als auch die Studierenden mittels der Erörterung oder der interaktiven Abstimmung teil.

Die Veröffentlichung des WebQuests im Netz ermöglicht die Motivation der Studierenden auf die Erreichung der besten Lernergebnisse wesentlich zu erhöhen.

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**Turadze R. A.**

### **CELTIC INFLUENCE ON THE ENGLISH LANGUAGE**

*Scientific Advisor – Senior Lecturer Krasnopyorov P. V.*  
*Language Advisor – Senior Lecturer Krasnopyorov P. V.*

The perceived lack of Celtic loanwords in English has generally been seen as

proof that the Anglo-Saxon invaders made short notice of their Celtic predecessors when they took possession of Britain during the fifth century. Thus, the Celts simply would not have had the chance to leave their mark on the English language as they were either killed, driven into the sea or had to take refuge in the mountainous West and North of Britain. The possibility of any Celtic influence on the very structure of English has been discounted altogether.

In recent years, this view has met mounting opposition from different fields of study. New archaeological evidence as well as a methodological reassessment have called for re-examination of the history of the Anglo-Saxon immigration.

While Anglo-Saxon culture and language spread swiftly across east and central Britain during the 6th and 7th centuries, corners of the isle retained the languages of the previous dominant culture, the Celtic peoples who are believed to have begun arriving around 600 BC. Today, the people who inhabit these areas take a pride in preserving these languages as a way of protecting their heritage. However, the Celtic peoples who invaded Britain are believed to have integrated with the people who previously inhabited the island, absorbing elements of the language spoken by this group, much in the way that the Normans were later to adopt many English words in order to adapt to their new homeland. The Celts had already spread their influence across most of central Europe and interacted with the Germanic tribes. Their languages were not retained in Europe for the most part, but their influence can be seen through subtle changes – in France for example, the use of Latin was modified through the local influences of Celtic languages. Dialects spoken in northern Spain are heavily influenced by Celtic to this day (due to influences both prior to the Celts arriving in Britain, and on their return after fleeing the Anglo-Saxon invasions). There is also a noticeable correspondence between northern Italian place names and similar names in Cornwall, starting with “tre-” (a Celtic word for a farm or settlement)(Claire Lovis).

Celtic words in OE come from three identifiable sources – from the continent (usually words associated with conflict and battle – the Celts were often used as

“armies for hire”), loans taken over after settlement (usually place names), and words from Ireland frequently associated with the Christianization of Britain. The Celtic language group has been categorized as part of the Indo-European group of languages, yet some studies have shown that there are features of Celtic language syntax that is not Indo-European, and in fact shares much in common with the Hamito-Semitic group of languages. This would indicate a fusion of native and newly imposed language on people who used their own grammar patterns to make sense of an unfamiliar language, and reflects the extent to which the Celts spread themselves across the continent. Not a great deal is known about those who inhabited the British Isles before the Celts, but it is interesting to think that their languages, lost forever, may survive in some way through the preservation of other languages (Bailey, 1999).

However, the Anglo-Saxons terrorized rather than integrated with the Celts, and so their languages became isolated in corners of the isle, until the efficiency of the Norman conquest created a linguistic hierarchy with Celtic languages entrenched firmly at the bottom. The pockets of land that remained dominantly Celtic are divided linguistically into two branches – Goidelic (Gaelic) and Brythonic (British). The Goidelic languages consist of Irish, Highland Scottish and Manx. The Brythonic is made up of Welsh, Cornish and Breton. Of these, perhaps Welsh is the one to survive most strongly in the present day, mainly due to the efforts of the Welsh seeking to preserve their culture and identity part from the English (Richard Hogg. 1992).

The social stigma attached to the worth of Celtic languages in British society throughout the last thousand years seems responsible for the dearth of Celtic loan words in the English language, a language renowned for its borrowing of words from many other languages. Celtic languages were viewed as inferior, and words that have survived are usually words with geographical significance, and place names. Adopted words include “bucket”, “car”, “crockery”, “noggin”, “gob”, “slogan” and “flannel”, “truant” and “goal” (although these words entered general

English usage at a later date – certainly post-Norman conquest). The survival of the Celtic languages has been a matter of pride, and they have survived mainly where numbers were large enough to enable its survival through everyday usage, as well as having their importance emphasized through the establishment of a body of literary work. Unfortunately, the various branches became geographically isolated, preventing any opportunity at standardization as an alternative to the centralized English social and political structure.

Besides, new advances in contact linguistics provide tools with which a more detailed look on the history of the English language has become possible. These developments have led to a new approach to the question of Celtic influence on the English language. The new argument runs that the dearth of Celtic loanwords in Old English can rather be seen as proof for the rapid shift of the indigenous peoples from Celtic to Anglo-Saxon speech, taking with them hardly any loanwords. Due to their “imperfect learning” of the Anglo-Saxon language the Britons are assumed to have carried over a number of morphosyntactic and phonological features from Brittonic that, found their way into the general spoken language of the people due to the large number of British-influenced speakers of Anglo-Saxon. This linguistic interference is then assumed to have influenced a number of changes in the English language.

Expectably, this view has met (sometimes quite sharp) opposition from scholars who, discount the possibility of any Celtic influences on the English language for a variety of reasons. They attribute the changes of the English language to internal developments or, at most, medieval language contact with speakers of Old Norse in the Danelaw.

The problem remains, that although the possibility of language contact influence from the Celtic languages can be established, it can rarely be proven to be the sole cause of any given feature. It may turn out that a possible compromise lies in the middle ground of multicausation, with Celtic influences acting upon and reinforcing trends already present in the English language. On the other hand,

settling for multicausation may in cases be the ‘easy’ answer, obstructing the search for the real origin of a feature.

In assessing this question, it remains important not to fall for the extremes. Indeed, Graham Isaac warns of abandoning basic linguistic methodology out of an enthusiasm for language contact (Isaac, 2003, p.63). Hildegard Tristram, on the other hand cautions against remnants of Anglo-Saxonist attitudes that provide an ideological barrier against the consideration of possible contact influences from Celtic languages (Tristram, 1999, p.31). Filppula point out that, “despite an obvious need for further research in many areas, the time is ripe for a critical reassessment of the ‘textbook’ views on the nature and outcome of the Celtic-English contacts” (Filppula, 2002, p.22).

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**Tykhonova M. Ye.**

**USING DIGITAL TOOLS DURING DISTANCE LEARNING IN FOREIGN  
LANGUAGE LEARNING**

*Senior Lecturer, Kharkiv Technical University  
“Kharkiv Polytechnic Institute”, Department of Foreign Languages*

Increasingly, the form of education for students is changing from classroom to distance learning. This is especially relevant now, in conditions of war for students who wish to study at Ukrainian universities, being abroad, or living in different parts of our country without the opportunity to come and study, for example, in Kharkiv, as in a hot spot. But life goes on, and we find a way out of almost hopeless situations. We are helped by such important and irreplaceable components in the field of education as a number of modern interactive platforms, online services and various tools for implementing an effective and successful educational process.

Today, a modern teacher has in his methodological baggage a variety of widespread information and communication technologies that not only contribute to effective interaction between all participants in the educational process, regardless of their location, but also provide the opportunity to do this at any time. And one of the most accessible and convenient means of distance learning is the online service Google Classroom.

What is it? Google Classroom is a powerful web service where students and teachers can hold virtual meetings for distance learning. The very good point of it is being free for all users, including teachers and students, and being accessed and logged in from a PC (via the web version) or from a mobile phone, using applications for Android and iPhone. Google Classroom is an online platform used as a virtual classroom that connects applications such as Google Docs, Google



Sheets, Google Drive, Google Forms, Gmail and many others, and aims to diversify and facilitate the work of teachers and students in real time from any device.

By creating different classrooms for each group of students, teachers can individually monitor the behavior of each student, as well as the level of teaching in each class separately, and can also change the content according to the level of difficulty. With Google Classroom, the grades received by students are recorded on the platform, and the date of submission of each activity is also recorded, which allows the teacher to monitor the situation with the progress of each student more quickly and in a personalized way. If a student misses a class, the content is stored in the virtual classroom. Students can also view each other's results to compare and track the progress of the class. The teacher has the opportunity to return grades and feedback individually. It should be noted that students follow the classes in real time, at a time agreed with their teachers via the virtual Google calendar.

A few words about the functional features. We are talking about free use, registration is possible only through the mail service Gmail. The interface language can be any. There is an integrated journal with grades, a news feed, integration with Google Calendar. The possibilities of conducting video conferences and access to documents, including textbooks, assignments, and tests for students, have been implemented.

When using educational platforms, it is recommended to conduct a test of students' general computer literacy and, if necessary, recommend courses to improve computer skills in general and the use of online programs in particular. When considering innovative technologies for use, for example, the Moodle platform, it is important to note that the main problem is their effective and correct application, and the work of the teacher is a key component.

Moodle does not stimulate teaching or learning, its effectiveness lies in the active and interactive participation of teachers and students. Thanks to the use of innovative technologies in foreign language learning, learning becomes more student-oriented and time-efficient. Virtual learning environments maximize

interaction and collaboration, interest in learning and obtaining new information. Using the Moodle for teaching a foreign language, teachers can create an environment for continuous learning with unlimited possibilities for control, making changes, archiving, viewing, etc., and most importantly, for close interaction between students and the teacher. For fruitful work and achieving the set results, technical and computer training of both teachers and students is important. Therefore, it is recommended to conduct trainings and seminars to improve the professional level of foreign language teachers who administer Moodle courses and students who use them. We see prospects for further research in this direction in the analysis.

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**Zakipna A. O.**

**PSYCHOLOGICAL FOUNDATIONS OF MODERN HR MANAGEMENT**

*Language Advisor – Asst. Prof. Chevychelova O. O.*

In today's environment, HR management is based not only on administrative functions but also on understanding the psychological aspects that affect the work, motivation, and behaviour of employees. This allows for the creation of a

productive and comfortable working environment. This article examines key psychological theories and their practical application to improve team performance.

Personnel psychology helps to better understand people's behaviour, needs, and motivations, enabling managers to build effective communication and structure processes appropriately. Employees are not merely task performers; they have personal needs that require attention. Motivation increases when employees understand the significance of their work and receive recognition. A healthy corporate culture fosters open communication and trust. Social needs and self-actualisation are becoming increasingly important, particularly for younger workers.

To address and meet employee needs, managers can focus on fundamental motivation theories. Maslow's hierarchy of needs highlights that people initially satisfy basic physical needs, such as safety and stability, before striving for social fulfilment and personal growth. This approach helps in designing reward and incentive systems tailored to different levels of need.

Herzberg's theory identifies hygienic and motivational factors, suggesting that while basic needs must be met, true motivation arises only when employees have opportunities for development and achievement.

Vroom's expectancy theory emphasises that people are more motivated when they believe their efforts will lead to desired results, underlining the importance of clear goal-setting and management feedback.

Modern HR management increasingly incorporates technology to address psychological factors. For instance, AI tools can analyse employee feedback, monitor satisfaction levels, and predict potential turnover, offering insights that allow managers to adapt interventions to employee needs. Virtual reality training programs create immersive experiences for developing skills like conflict resolution and leadership in safe environments, fostering emotional intelligence and collaborative abilities.

Emotional intelligence is crucial for effective teamwork and leadership. Employees with high emotional intelligence manage their emotions better and

communicate more effectively, while leaders with this skill can inspire and support their teams. Organisations that integrate emotional intelligence principles into their programs report reduced conflict levels, improved communication, and enhanced overall efficiency. Psychological safety is another key element, as employees who feel safe expressing their opinions openly are more creative and engaged in their work. Regular recognition of effort and constructive feedback also help sustain motivation and improve performance.

Building resilience has become a priority in HR management, especially following recent global challenges such as the COVID-19 pandemic. Organisations are introducing wellness programs, mental health support, and flexible work arrangements to help employees cope with stress, adapt to change, and remain productive, contributing to a more stable and engaged workforce. Behavioural approaches to leadership also focus on reinforcing desired actions. Positive reinforcement, such as recognition or rewards, encourages employees to repeat successful behaviours, while removing negative factors like excessive control or stress further enhances performance. Leading companies like Google demonstrate the success of these methods by implementing flexible work schedules and rewarding innovative ideas.

Organisations use various tools to implement these approaches. Surveys assessing employee motivation provide insights that help align corporate values and incentives with actual needs. Emotional intelligence training reduces conflicts and strengthens team cooperation. International companies such as Apple and Amazon actively apply psychological theories to develop employee incentives, training programs, and support initiatives. Psychological aspects of HR management are therefore integral to creating an effective working environment. Incorporating modern psychological approaches enhances motivation, productivity, and job satisfaction. Managers who focus on employees' psychological needs, encourage growth, provide positive feedback, and adhere to the principles of emotional intelligence and safety achieve the best outcomes.

In conclusion, the integration of psychological principles into HR management is no longer optional but essential for organisations aiming to succeed in a competitive and rapidly changing world. By fostering motivation, emotional intelligence, and psychological safety, companies not only create a supportive and engaging work environment but also ensure long-term productivity and success. Managers who prioritise these aspects will be better positioned to attract and retain top talent, drive innovation, and maintain high levels of employee satisfaction. The psychological approach to HR is a cornerstone of modern management, bridging the gap between organisational goals and the personal aspirations of employees.

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# ECONOMIC SCIENCES

**Bezpala V. S.**

## **THE ROLE OF INNOVATION IN ENHANCING COMPETITIVENESS OF SMALL AND MEDIUM-SIZED ENTERPRISES IN THE MODERN BUSINESS ENVIRONMENT**

*Language Advisor – Asst. Prof. Skrypnyk N. S.*

Small and medium-sized enterprises (SMEs) play a crucial role in the global economy, contributing significantly to employment and economic growth. However, they face numerous challenges in the modern business environment, including intense competition, rapid technological advancements, and evolving consumer preferences. Innovation has emerged as a key driver of competitiveness for SMEs, enabling them to adapt, differentiate, and thrive in dynamic markets. This article explores the role of innovation in enhancing the competitiveness of SMEs, examining various types of innovation, the benefits they offer, and the challenges faced in their implementation.

Innovation can be broadly categorized into product innovation, process innovation, marketing innovation, and organizational innovation. Product innovation involves the development of new or improved goods or services, offering novel features, functionalities, or designs. Process innovation focuses on enhancing the efficiency and effectiveness of internal operations, such as manufacturing, logistics, or customer service. Marketing innovation involves implementing new marketing strategies, channels, or promotional techniques to reach and engage customers. Organizational innovation entails restructuring the organization, adopting new management practices, or fostering a culture of creativity and experimentation.

In the fields of entrepreneurship, trade, and stock exchange activity, product innovations can manifest in various forms. For instance, developing new mobile applications for online commerce, implementing augmented reality technology for

virtual clothing try-ons, creating personalized recommendation systems for shoppers, and developing new financial instruments such as cryptocurrency payment systems. A crucial aspect of product innovation is considering shifting consumer preferences and market trends.

Implementing innovation offers several benefits for SMEs. Firstly, it allows them to differentiate themselves from competitors, creating unique value propositions and attracting customers. Secondly, innovation can lead to cost reductions through improved processes and resource utilization. Thirdly, it enables SMEs to adapt to changing market conditions and customer demands, ensuring long-term sustainability. Finally, innovation can enhance the reputation and brand image of SMEs, attracting investors, partners, and skilled employees.

Despite the numerous benefits, SMEs face several challenges in implementing innovation. A major constraint is limited access to financial resources, which are often required for research and development, prototyping, and marketing. Furthermore, SMEs may lack the specialized skills and expertise needed for certain types of innovation. Another challenge is the risk aversion that can prevail in smaller organizations, hindering the willingness to experiment and embrace new ideas. Finally, SMEs may face difficulties in protecting their intellectual property, making them vulnerable to imitation by larger competitors. In addition to the challenges mentioned, SMEs also face difficulties adapting to the rapid digitalization of the business environment. This includes the need to invest in new technologies, develop the digital competencies of personnel, ensure cybersecurity and data protection. Not all SMEs possess sufficient resources and knowledge for the effective implementation of digital technologies, which can create additional barriers to their development.

Overcoming these challenges requires a multifaceted approach. Governments can play a crucial role in supporting SME innovation through funding programs, tax incentives, and regulatory frameworks that foster competition and protect intellectual property. Business incubators and accelerators can provide valuable

resources, mentorship, and networking opportunities for innovative SMEs. Universities and research institutions can collaborate with SMEs on research and development projects, facilitating technology transfer and knowledge sharing. Finally, SMEs themselves need to foster a culture of innovation, encouraging employee creativity, investing in training and development, and embracing open innovation practices. One example of successful cooperation between business and science is joint projects for the development of new technologies in the field of energy efficiency. Companies specializing in the production of energy-saving equipment actively collaborate with universities and research institutions to develop innovative solutions. This allows them to gain access to advanced technologies and knowledge, as well as attract qualified specialists to implement their projects.

In conclusion, innovation is essential for the competitiveness and survival of SMEs in the modern business environment. By embracing various types of innovation and addressing the challenges they face, SMEs can differentiate themselves, enhance their efficiency, adapt to market changes, and achieve sustainable growth. A collaborative effort between governments, support organizations, and SMEs themselves is crucial to fostering a thriving innovation ecosystem that empowers SMEs to thrive in the global marketplace.

The development of innovation activities of SMEs in Ukraine has significant potential for stimulating economic growth and increasing the competitiveness of the national economy. However, realizing this potential requires a comprehensive approach that includes creating a favorable investment climate, developing innovation infrastructure, supporting research and development activities, and fostering a culture of innovation in society.



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**Butenko D. S.**  
**THE LAND MARKET IN UKRAINE: KEY ASPECTS AND**  
**IMPLICATIONS**

*Language Advisor – Senior Lecturer Nosyryeva O. V.*

Ukraine's vast and fertile agricultural lands have long been recognized as a cornerstone of its economic potential. Despite this, the land market was frozen for decades due to a moratorium on agricultural land sales, imposed in 2001. This restriction was initially aimed at protecting small farmers during the post-Soviet transition but ultimately created a range of economic and legal challenges. The moratorium was lifted on July 1, 2021, marking a turning point in Ukraine's agrarian policy. This reform has sparked widespread discussions about its benefits, risks, and long-term implications.

The moratorium restricted the sale and purchase of agricultural land, leaving around 40 million hectares under-utilized. Instead of creating a transparent market, it fostered illegal leasing practices and corruption. Landowners were forced to rent out their plots for low fees, often without legal protection. Meanwhile, the lack of investment deterred modernization in the agricultural sector. The reform aimed to

resolve these issues by introducing a regulated land market, stimulating economic growth, and attracting foreign investment.

### Key Provisions of the Land Reform

#### 1. Phased Introduction

The reform is being implemented gradually. From 2021, only individuals who are Ukrainian citizens can purchase up to 100 hectares of land. Starting in 2024, legal entities registered in Ukraine will be allowed to buy land, with a maximum limit of 10,000 hectares.

#### 2. Land Valuation and Pricing

A minimum price is determined by the normative monetary valuation of the land. This provision ensures fair competition and prevents speculative underpricing.

#### 3. Restrictions on Foreign Ownership

The sale of land to foreigners remains prohibited until a national referendum decides otherwise. This restriction reflects public concerns about losing control over strategic resources.

#### 4. Transparency and Digitalization

The government has introduced a land registry system to ensure transparency in transactions. This system allows public access to information about land ownership and transactions.

### Economic Implications

#### 1. Increased Investments

By providing clear ownership rights, the reform encourages both domestic and international investments in agriculture and related industries.

#### 2. Credit Access

Farmers can now use their land as collateral to secure loans for modernization and expansion.

#### 3. Improved Land Use Efficiency

A competitive market incentivizes optimal use of land resources, boosting overall productivity.

## Challenges and Risks

### 1. Corruption and Oligarch Control

Critics fear that wealthy entities might exploit legal loopholes to acquire large tracts of land.

### 2. Social Resistance

Many rural communities remain skeptical of the reform, fearing displacement or unfair competition.

### 3. Infrastructure Gaps

The success of the reform depends on well-functioning registries and dispute resolution mechanisms.

The launch of the land market in Ukraine on July 1, 2021, marked a historic milestone in the country's economic and social transformation. With over 40 million hectares of fertile soil, Ukraine's agricultural sector holds immense potential to become a global leader in food production. However, for decades, the moratorium on agricultural land sales stifled progress, locking billions of dollars in untapped capital and limiting opportunities for farmers and investors alike.

By opening the land market, Ukraine has begun addressing these systemic issues. The reform has introduced mechanisms for regulated land sales, established safeguards to prevent speculative pricing, and prioritized the rights of Ukrainian citizens in land ownership. Additionally, the new market has the potential to drive significant economic growth by increasing investments, modernizing agricultural practices, and improving the efficiency of land use. These changes could elevate Ukraine's status as an agricultural powerhouse and contribute to the broader development of rural communities.

Nevertheless, the reform's success depends on addressing several challenges. Ensuring transparency and preventing corruption are paramount, especially given historical concerns over oligarchic control of resources. Effective implementation of digital land registries and the establishment of fair dispute resolution mechanisms are critical for building trust among stakeholders. Furthermore, public

outreach and education are essential to mitigate resistance in rural communities, where skepticism and fear of displacement remain significant.

Social equity must also remain a core principle of the reform. Small and medium-sized farmers must receive the necessary support, such as access to affordable loans and training on sustainable practices, to compete effectively in the new market environment. Infrastructure improvements, particularly in transportation and logistics, are equally vital to unlock the full potential of Ukraine's agriculture.

The prohibition on foreign ownership, while politically expedient, raises questions about the pace of future liberalization. If managed carefully, lifting this restriction could attract much-needed international investment. However, such a step must be balanced against concerns over national security and the protection of Ukraine's most strategic resource – its land.

In conclusion, the land market reform in Ukraine is a bold and transformative step, representing both an opportunity and a challenge. It has the potential to unlock significant economic growth and improve the livelihoods of millions. However, its long-term success requires careful and transparent governance, active stakeholder engagement, and ongoing investments in infrastructure and education. If Ukraine successfully navigates these complexities, it could set an example of how thoughtful land reform can drive sustainable development, strengthen economic resilience, and foster social stability.

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**Derevianko O. M.**

**CURRENT ASSETS OF THE ENTERPRISE: CONDITION AND EFFICIENCY**

*Language Advisor – Cand. Ped. Sc., Assoc. Prof. Skrypnyk N. S.*

Economic relations are an integral part of social life, affecting people's well-being, economic development and quality of life. Modern technologies, globalization and networked communities are changing living conditions, which requires deep knowledge of information technologies and economic methods to solve complex problems in the field of economics.

In the context of a market economy, effective management of current assets is of key importance, which forms a financial management strategy aimed at optimizing their use and increasing the value of the enterprise. In the modern economic market, solving the problem of providing current assets becomes an extremely important task for successful production and economic activity (Батракова Т.І., Бондар В.В., 2015).

Rational and economical use of the elements of the enterprise's working capital is of extremely important economic importance. This is explained by the growing scale of consumption of raw materials, materials and energy for the

production of products in various sectors of the economy, as well as a significant share of material costs in the total cost of production. Saving material resources, which is manifested in a decrease in the absolute and relative consumption of individual types of these resources, allows you to produce more products from the same number of raw materials and materials without additional social labour costs, increasing the efficiency of production at each enterprise (Дробишева О. О, 2016).

The production of products, the performance of work or the provision of services is carried out through the interaction of human labour and means of production. The latter, by their material composition, are the means of production of the enterprise, which are divided into fixed and circulating assets according to their characteristics.

Current assets are a part of the means of production, which includes a set of objects of labour that are completely consumed during each production cycle, change or lose their natural form, and transfer their entire value to the cost of products produced or services provided.

Elements of working capital constitute the material basis of manufactured products, including raw materials and construction materials. They provide conditions for carrying out technological processes and the operation of production equipment, and for the storage and transportation of raw materials and finished products.

At the beginning of production and economic activity, the enterprise must have a certain reserve of cash. With these resources, it buys raw materials, materials, fuel, pays electricity bills, pays wages, and invests in the development of new products. All this constitutes one of the key components of economic activity, known as the «working capital» of enterprises. In market conditions, working capital acquires special importance, since it is part of the productive capital, which transfers its value to newly created products and returns to the enterprise in cash after each capital turnover. Therefore, working capital is an important indicator in determining the profitability of the enterprise.

Current assets are part of the property of enterprises and are in constant motion, carrying out the corresponding circulation. They pass from cash to production stocks, from production stocks to work in progress, from work in progress to finished products. After completing one cycle, they begin a new one. Thus, their continuous circulation is ensured by a constant change in the forms of value: from monetary it is transformed into commodity, then into production, and again into commodity and monetary forms.

Thus, in the conditions of commodity-money relations, the value of circulating assets is advanced, not spent, since, passing through all phases of circulation, it returns to its original state.

Current assets are divided into working capital, which serves the production sector, and circulating capital, which serves the circulation sector. Working capital includes production inventories, work in progress, low-value and quickly depreciating items, and deferred expenses (Причепя И. В., Руда Л. П., 2017).

Current assets include finished products in the company's warehouse and shipped products for which payment has not yet been received, goods of third-party origin purchased for further profitable resale, funds in settlements, cash in bank accounts and in cash.

Current assets serve the production sector, their main function is to ensure the continuity and rhythm of the production process. The main part of current assets is made up of labour items: raw materials, basic and auxiliary materials, packaging, fuel, semi-finished products. Current assets also include tools: low-value and quickly worn materials, tools, special devices, inventory, spare parts for routine repairs, work and special clothing, work shoes. These tools are used for less than a year or have a cost limit. Due to their number and complexity of accounting as fixed assets and depreciation, they are classified as production inventories. Current assets also include costs of work in progress and expenses of future periods.

Circulating funds ensure the process of production and sale of products, ensuring the connection between production and circulation. This group includes:

finished products, shipped goods, work performed and services provided, cash in the company's cash register and on its accounts, funds in settlements in the form of receivables.

Effective use of current assets is becoming a key condition for the successful functioning of an enterprise in a competitive environment. It is important to develop effective methods for analysing their use, which will improve the quality of management decisions aimed at optimizing current assets and the overall efficiency of the enterprise (Терещенко С. І., Федай В. В., 2019).

Therefore, economic efficiency is the main focus in economic theory and practice. It reflects the relationship between resources and the results of the production process, in which not only material output is important, but also the consumer value of this output. Economic efficiency takes into account the results of the use of labor, materials and equipment over a certain period of time (Дмитрук Б. П., 1998).

The study shows that the establishment of scientifically based performance indicators allows for an objective assessment of the state of affairs at the enterprise and the adoption of timely measures to improve the efficiency of production activities.

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**Dovhopol O. Y.**  
**CONCEPTUAL PRINCIPLES FOR THE FORMATION**  
**OF SUSTAINABLE DEVELOPMENT OF AN ENTERPRISE**

*Scientific Advisor – Assoc. Prof. Dedilova T. V.*  
*Language Advisor – Cand. Ped. Sc., Assoc. Prof. Skrypnyk N. S.*

The strategic concept of sustainable development was adopted at the UN World Conference on Environment and Development at the Earth Summit held in Rio in 1992. The idea for this concept was driven by significant changes in various spheres of society, namely social, economic and environmental, which are associated with the following needs:

- economic development: achieving sustainable economic growth that takes into account the needs of not only present but also future generations;
- social equality: equal opportunities and free access to any basic services;
- environmental protection: minimizing the negative impact of human activity on nature;
- rational use of resources: the balanced use of energy, water, land and other natural resources to ensure their availability for present and future generations.

It is also worth noting that sustainable development has become the guiding vision for development efforts in all countries, which implies a new vision and way of thinking. Sustainable development has become one of the key factors that has

helped to ensure the competitiveness of enterprises and is one of the main directions in their development in the current business environment.

The main result of the conference was the definition of sustainable development as a concept that ensures that current needs are met without compromising the ability of future generations to meet their needs. The idea behind the concept is that indicators such as the quality of life and the state of society directly depend on the interconnection of three types of factors: economic, social and environmental.

In modern economic science, the issue of ensuring sustainable development of business entities is a relevant one. Sustainable development, according to some researchers, is a process of constant change, in which the use of resources, innovation, scientific and technological progress, staff development and institutional transformation are aimed at improving performance, competitiveness, meeting needs and achieving strategic goals in harmony with the environment (Andrushkiv, Melnyk, Pohaidak, 2016).

S. Kozlovsky believes that the concepts of "sustainability" and "stability" should be linked to each other. He emphasizes that sustainability means the ability to function in balance, while stability means the ability to remain unchanged (Kozlovsky, 2011).

According to Ukrainian scholar K. Ivanchuk, the term "sustainability" is defined as the ability to return to balance after deviations caused by destabilizing influences of external and internal factors.

Sustainable development is "a process of balanced economic and social development subject to environmental criteria, reproduction of the natural environment, taking into account the requirements of present and future generations" as defined by Osaulenko and Zakharchenko (Osaulenko, 2009, p. 8; Zakharchenko, 2015, p. 69-70).

Thus, based on the opinions of modern scholars, it is advisable to present the concept of sustainable development in its triune interpretation (Fig. 1.1). According

to Fig. 1.1, sustainable development includes three main aspects: economic, social and environmental. The economic aspect involves the rational use of natural resources with the help of modern technologies aimed at creating environmentally friendly products or services. The social aspect is focused on improving the quality of life, equal access to goods and services, improving working conditions and ensuring stability in society. The environmental aspect involves preserving natural systems, reducing environmental pollution and restoring the environment after human activity. Research confirms that the economic aspect plays an important role in sustainable development and has a major impact on other components. It creates the basis for the successful implementation of social and environmental initiatives, contributing to the harmonious development of society and the environment.

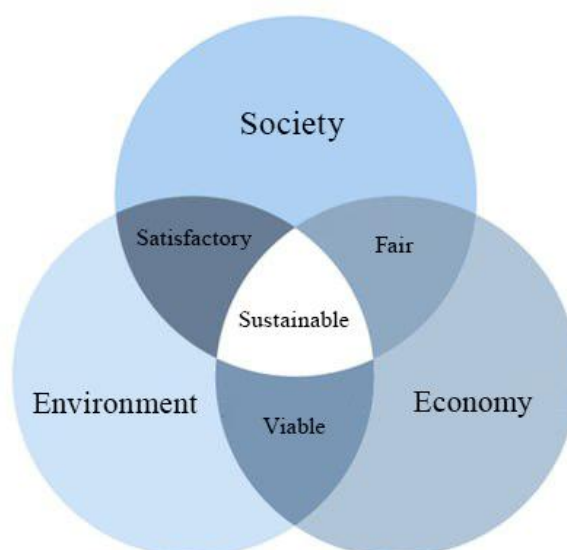


Figure 1.1 - The triune concept of sustainable development

According to these conditions, the concept of sustainable development, as scientists believe, should be based on the following principles (Melnyk, 2005, p. 462; Vasiutkina, 2014, p.83-84):

- the principle of balance (ensuring proportional growth in the economic, social and environmental spheres);

- the principle of achieving goals (creating conditions for the system's self-development based on the use of advanced scientific, technical and production potential, which promotes harmony with the environment and the ecological orientation of socio-economic development);
- the principle of balance (maintaining a balance between natural, industrial and socio-economic aspects);
- the principle of adaptability (the ability of the system to adapt to changes in the external environment that affect its further development);
- the principle of dynamism (a change in one aspect of the business leads to a change in other aspects);
- the principle of comprehensiveness (ensuring proportionate and balanced development of all areas and elements, including operational, financial and investment);
- the principle of eco-motivation (indicates the need to harmonize motivational means to achieve the goal of economic greening).

Progress in the sustainable development system depends on the effective interaction, balance and harmonization of its components. For example, the combination of economic and social aspects contributes to the fair distribution of income and benefits among all stakeholders. The economic subsystem has a direct impact on the social and environmental subsystems, contributing to their balanced development. The social subsystem, in turn, indirectly influences the environmental subsystem by raising environmental awareness and supporting environmental protection measures. The environmental subsystem has a direct impact on the economic subsystem, as the use of resource-saving technologies saves money, and compliance with environmental standards increases the trust of all stakeholders in the business.

The interaction of the components of the sustainable development system at the enterprise level results in a higher level of systemic sustainable development, which enables enterprises to meet their needs, generate profits, improve their image

as producers of environmentally friendly products, optimise energy consumption and reduce production waste.

Analyzing the definition of "sustainable development of enterprises" (Andrushkiv, Melnyk, Pohaidak, 2016, p. 9; Ivanchuk, 2014; Zakharchenko, 2015), we can formulate the following interpretation of this term: sustainable development of an enterprise is a continuous process of qualitative changes aimed at improving the efficiency and effectiveness of its activities. This process includes formulation and implementation of development strategies, achievement of strategic goals based on harmonization and balancing of subsystems and environmental protection. It is important to take into account both quantitative, structural and qualitative changes, as well as limitations from the external environment and institutional capacity.

The main goal of sustainable development is to find an optimal balance between socio-economic development and the use of resources in such a way as to ensure environmental safety and guarantee an adequate quality of life and well-being of people without threatening the resource potential of future generations. In this context, it is necessary to ensure the financial sustainability of the enterprise as an environmentally and socially responsible business entity that meets the needs of its operation and development, satisfies the interests of all stakeholders, provides appropriate working conditions for its employees, contributes to the development of society and minimizes the negative impact on the environment. This creates opportunities for comprehensive and systematic interaction of the company's internal and external environment based on the principles of sustainable development (Andrushkiv, Melnyk, Pohaidak, 2016, p. 4).

Sustainable development of enterprises is a strategically important area that ensures the harmonization of economic, social and environmental aspects. It is aimed at long-term competitiveness, meeting the needs of generations and minimizing environmental impact. The implementation of the principles of balance, adaptability and eco-motivation promotes efficient use of resources, innovation,

social stability and environmental responsibility. Implementing the concept of sustainable development allows businesses to increase efficiency, reduce risks, strengthen market positions and contribute to the welfare of society, ensuring harmonious interaction between business, society and nature.

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**Kamal S. E.**  
**RISK MANAGEMENT OF FOREIGN ECONOMIC ACTIVITY OF A  
BANKING INSTITUTION**

*Language Advisor – Asst. Prof. Chevychelova O. O.*

Foreign economic risk is the possibility of adverse events that may lead to losses and property damage for participants in foreign economic activity (FEA). This is a special category of risks that usually arise during foreign economic transactions. According to the key aspects of international trade, FEA risk refers to the danger of losses due to the actions of the other party or changes in the political, economic, or other situations in the partner's country. This is a crucial aspect for banking institutions engaged in foreign economic activity, requiring careful attention and risk analysis for successful management.

When conducting foreign economic activity, the possibility of incurring losses exists for any participant, whether they are an importer, exporter, or financial institution such as a bank providing services. Therefore, it is important to clearly distinguish the various types of risks arising during international operations and study the methods and tools aimed at minimizing or even eliminating these risks.

Two main factors characterize FEA risks: macro-level and micro-level factors.

Macro-level factors include inflation, increasing public debt, changes in the legislation of the debtor country, political conditions, capital migration, and declining economic growth rates. Micro-level factors include insolvency and deterioration of the financial condition of the counterparty, exchange rate instability of the price (credit) currency and payment currency, and reduced trust in the partner.

By utilizing strategies and tools, it is possible to influence the level of risk through the creation of an effective risk management system, also known as risk management. The primary goal of this system is to achieve the organization's key business objectives.

Risk management includes:

- A management system

- A system of identification and measurement
- A system of monitoring and control

The risk management framework aims to achieve the following objectives:

- Risks must be understood and acknowledged by the organization's management.
- Decisions regarding risk acceptance must be specific, clear, and aligned with the company's strategic objectives.
- Expected profitability must compensate for the accepted risk.
- The allocation of capital must correspond to the size of the risks faced by the company.
- Incentives for achieving high performance must align with the level of risk tolerance.

Reports on entrepreneurial activity management in Ukraine reflect that a key problem in determining the volume of risk capital is the lack of necessary information to build loss distribution curves. This is particularly relevant for industries with high-risk levels and those operating under uncertainty. Thus, there is an objective need for a comprehensive assessment of the qualitative and quantitative methods applied.

Most domestic researchers believe that using a systematic approach is appropriate for qualitative risk analysis. This approach involves several stages:

- Conducting a comprehensive study of various aspects of the enterprise's activities and its operating environment, which may be sources of potential risks.
- Analyzing risk factors arising from both internal and external conditions of the enterprise's operations.
- Forming a logical chain of events that may occur under the influence of risk factors.
- Determining indicators of risk levels.
- Developing a risk management system within which mechanisms and models of interaction between indicators and risk factors are established.



Successful foreign economic activity today requires enterprises not only to understand potential risks but also to manage them effectively. By studying the main aspects of risks in foreign trade and methods of their management, it can be concluded that the key step for further research is the development of risk management procedures in foreign economic activity.

In conclusion, effective risk management of foreign economic activity is essential for banking institutions engaged in international trade. The identification and analysis of both macro-level risks (such as political conditions, inflation, and changes in the debtor country's legislation) and micro-level risks (including counterparty insolvency and currency instability) are crucial in understanding the full scope of potential threats. By implementing a robust risk management system that includes a management system, identification and measurement tools, and effective monitoring and control mechanisms, banks can better mitigate the impacts of these risks on their operations.

It is clear that risk management is not a one-time effort but a dynamic process that requires ongoing attention, particularly in an environment that is constantly influenced by political, economic, and technological changes. The success of a bank's foreign economic activities depends largely on its ability to adapt to these ever-changing risks and to ensure that strategic decisions regarding risk acceptance are aligned with the bank's long-term business goals.

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**Kukharyk V.V.**  
**INFLATION: ESSENCE, CAUSES, TYPES AND SOCIO-ECONOMIC**  
**CONSEQUENCES**

*Language Advisor – Lecturer Lukianenko N.M.*

Inflation is a socio-economic phenomenon caused by imbalances in production across different sectors of the market economy. It is one of the most severe manifestations of macroeconomic instability (Круш, Клименко, 2010).

There are different views on the nature and causes of inflation, but two main perspectives prevail: the first sees inflation as a purely monetary phenomenon, caused by a disruption of the laws of money circulation; the second sees it as a macroeconomic phenomenon, caused by a disruption of the proportions of social reproduction, particularly between production and consumption, and between supply and demand for goods.

Externally, inflation appears as the devaluation of money due to excessive issuance, accompanied by a rise in the prices of goods and services. However, this is only a manifestation, not the fundamental essence and cause of inflation. Of course, inflation has its external manifestation in price increases. But not every price increase is an indicator of inflation. Prices may increase as a result of improvements in product quality, deterioration in the conditions of extracting fuel and raw material resources, or changes influenced by cyclical and seasonal production fluctuations, natural disasters, etc. However, these are usually not inflationary, but rather, to some extent, natural periodic price changes for specific goods and services. (Базилевич, 2008).

In reality, inflation is the result of a disruption of economic equilibrium, which is caused by a combination of internal and external factors.

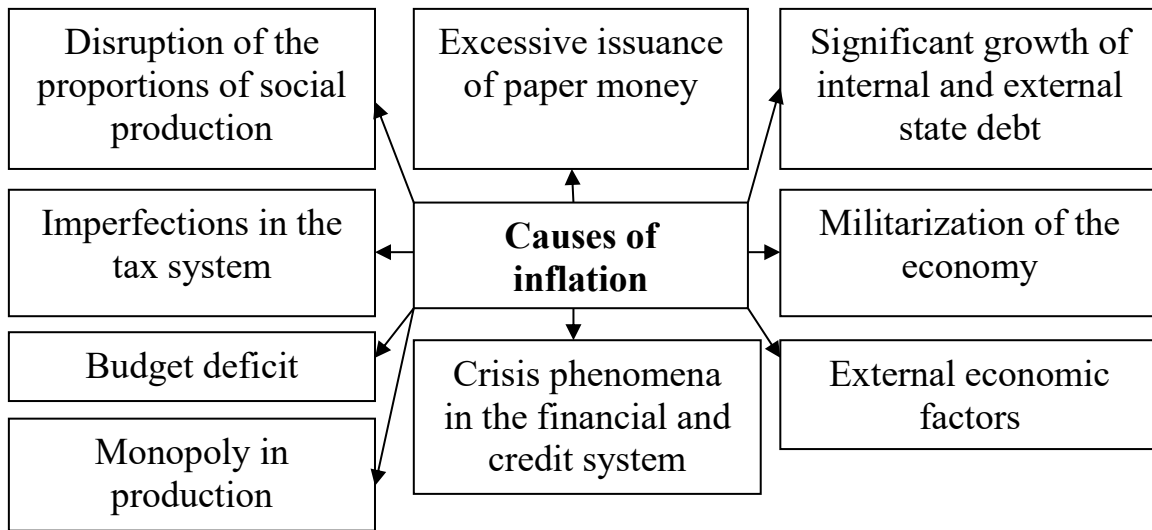


Fig. 1. The main causes of inflation (Базилевич, 2008).

Inflation can take various forms.

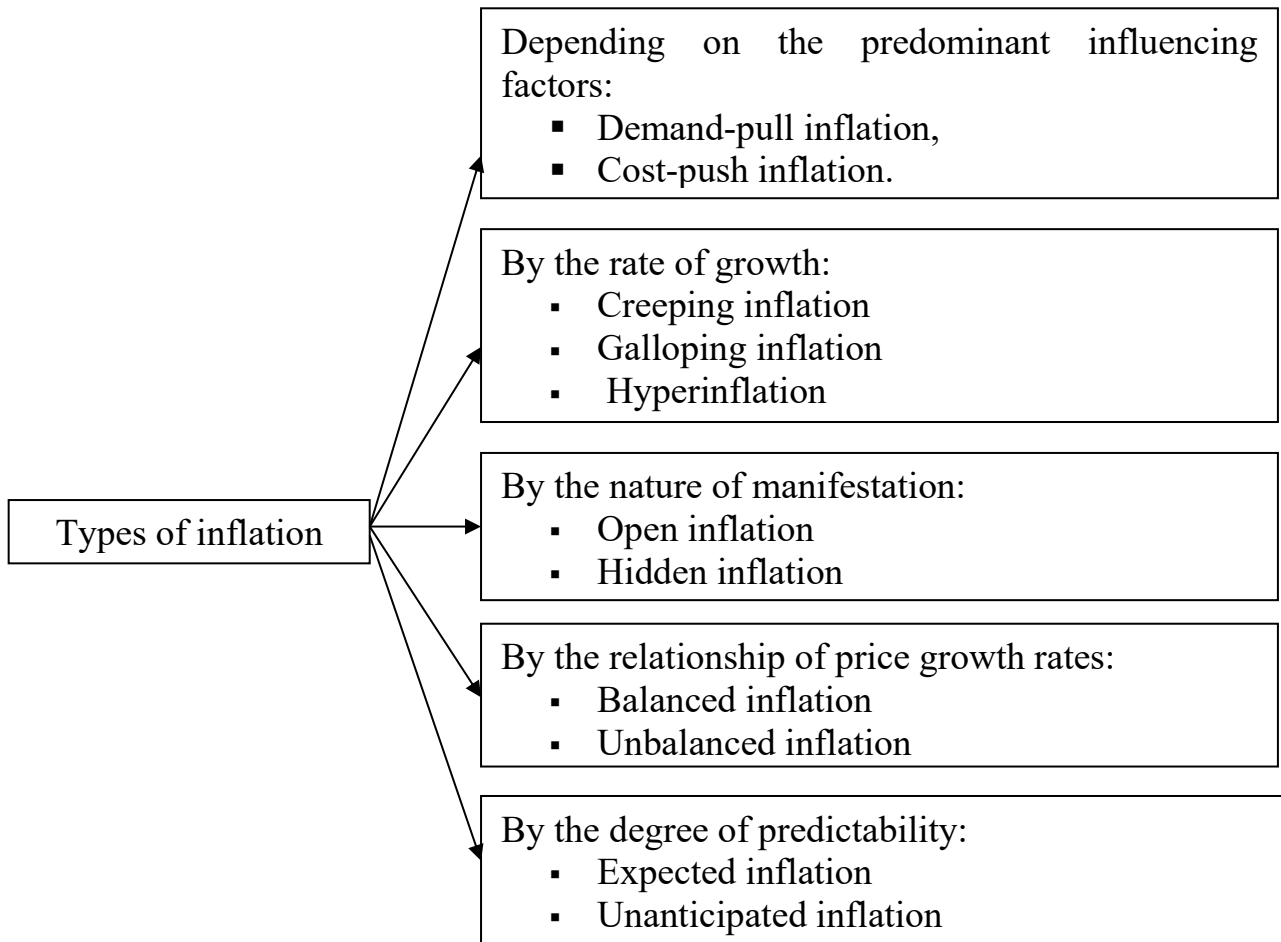


Fig. 2. Types of inflation (Cipko, 2014).

#### Socio-economic consequences of inflation.

Inflation is a severe economic illness with deep social and economic consequences. There is no country in the world that has not experienced losses from inflation to some degree.

#### Economic consequences of inflation.

Inflation disrupts normal economic relationships, intensifies chaos and disproportions in the economy, and disorganizes the investment process. With uncontrolled price increases, the goal of production (profit) can be achieved without increasing production.

Capital flows from the production sector into the circulation sector, primarily into speculative commercial structures, where it moves faster and generates huge profits. It also moves abroad in search of more profitable applications and guaranteed returns. This increases speculation, the shadow economy, and corruption.

The normal functioning of the credit and monetary system is disrupted. The devaluation of money undermines the incentives to accumulate it, leading to a phenomenon known as the "flight from money," where entrepreneurs and the population prefer to invest savings in goods, real estate, and other material assets.

Gradually, monetary relations contract, and direct product exchange based on barter agreements expands. This leads to a loss of money's economic functions, and exchange relationships revert to a simpler or random form of value.

Inflation negatively impacts the international economic and monetary-credit situation of a country. It undermines the competitiveness and export of domestic goods while stimulating the import of goods from abroad, as they are sold at higher prices in the domestic market. Inflation also hinders the inflow of foreign capital and lowers both the official and market exchange rates of the national currency due to its devaluation (Рибалкін, 2002).

#### Social consequences of inflation.

First, inflation lowers the standard of living for all social groups, especially those with fixed incomes, as income growth rates lag behind the increase in prices for goods and services.

Second, inflation devalues people's past savings in banks, insurance policies, annual rents, and other paper assets with a fixed value.

Third, inflation increases unemployment, undermines motivation for effective labor activity, exacerbates social differentiation, and increases social tension within society (Круш, Клименко, 2010).

To combat inflation, the state implements anti-inflationary policies, which involve both tactical (short-term) measures to reduce the current level of inflation and strategic (long-term) measures aimed at preventing inflation in the long term (Сірко, 2014).

As a result of the monetary reform in Ukraine in September 1996, the temporary currency unit, the coupon-karbovanets, was replaced with the new Ukrainian national currency, the hryvnia, which became the sole legal means of payment on the territory of Ukraine. The introduction of the hryvnia and the implementation of long-term anti-inflationary state policy were important factors in significantly reducing inflation levels and stabilizing the monetary circulation in the country (Базилевич, 2008).

Inflation is a multifaceted economic phenomenon with complex causes and consequences. While moderate inflation is often seen as a normal part of economic growth, excessive or uncontrolled inflation can have severe negative effects on an economy. Understanding the nature of inflation, its causes, and its various types is crucial for formulating effective economic policies.

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**Lytvyniuk O. V.**  
**GREEN ECONOMY AS A CATALYST FOR SUSTAINABLE  
DEVELOPMENT**

*Language Advisor – Asst. Prof. Chevychelova O. O.*

The transition to a green economy is an essential component of achieving sustainable development. As global environmental challenges intensify, economies worldwide are adopting strategies to balance economic growth, social equity, and environmental sustainability. This article explores the role of the green economy in fostering sustainable development, focusing on its principles, benefits, challenges, case studies, and emerging trends.

A green economy is guided by principles that prioritize environmental sustainability while ensuring economic viability and social inclusion. Resource efficiency involves optimizing the use of natural resources to reduce waste and minimize environmental degradation. Low-carbon development emphasizes transitioning from fossil fuels to renewable energy sources to mitigate climate change impacts. Social equity ensures that economic benefits are distributed equitably, addressing disparities in access to resources and opportunities. Circular economy practices promote recycling, reusing, and repurposing materials to create closed-loop systems, reducing waste and recovering valuable resources.

The green economy supports environmental protection by adopting sustainable practices that reduce carbon emissions, conserve biodiversity, and protect ecosystems. Economic growth is stimulated through investments in green technologies and industries, generating new economic opportunities, creating jobs, and fostering innovation. Energy security is enhanced by reducing dependence on imported fuels through domestic renewable energy infrastructure. Public health improves as reduced pollution from industrial activities leads to better air and water quality, decreasing health risks such as respiratory diseases.

Transitioning to a green economy requires substantial financial investment, which can be a barrier, especially for developing economies. The absence of clear and enforceable policies hinders the widespread adoption of green practices, while technological limitations, including access to advanced technologies and skilled labour, pose significant challenges. Resistance to change from traditional industries and stakeholders due to perceived threats to their interests further complicates the transition.

The transition to a green economy also highlights the need for fostering partnerships among governments, the private sector, and civil society. These collaborations can ensure the efficient implementation of green initiatives while pooling resources and expertise. Public-private partnerships, in particular, play a pivotal role in funding large-scale projects, such as renewable energy installations or eco-friendly infrastructure. Such partnerships can reduce the financial burden on individual entities while accelerating progress toward shared sustainability goals.

Education and training systems must also adapt to support the growth of the green economy. Introducing sustainability-focused curricula in schools, universities, and vocational training programmes can cultivate the knowledge and skills required for the jobs of the future. This preparation is essential not only for equipping individuals to participate in the green economy but also for empowering them to act as advocates for environmental sustainability in their communities and workplaces.

The role of consumers in supporting the green economy should not be underestimated. By choosing sustainable products and services, individuals can drive demand for environmentally friendly practices across industries. Consumers also have the power to influence corporate behaviour through advocacy and by favouring businesses that prioritise sustainability. Raising awareness of the impact of consumer choices is crucial to fostering a culture of environmental responsibility.

Germany's Energiewende initiative demonstrates the successful integration of renewable energy into the national grid, significantly reducing carbon emissions. The Netherlands has established itself as a leader in circular economic practices through comprehensive recycling programmes, with over 80% of construction materials being recycled. Singapore exemplifies green urban development with innovative planning policies and projects like Gardens by the Bay that integrate green spaces within urban areas. Norway's success in electric mobility, with over 70% of new car sales being electric, is attributed to subsidies, tax incentives, and extensive charging infrastructure.

Green finance is driving capital toward environmentally friendly projects through instruments like green bonds and climate-focused investment funds. Smart agriculture, including precision farming and vertical agriculture, optimises resource use, reduces waste, and increases productivity while minimising environmental impact. Green hydrogen, produced using renewable energy, is emerging as a key fuel for decarbonising industries like steel and shipping. Carbon capture and storage technologies are gaining traction as methods to reduce greenhouse gas concentrations by capturing emissions from industrial processes and storing them underground.

The green economy offers a viable pathway to sustainable development by harmonising economic, environmental, and social goals. Despite challenges, the transition to green practices is essential for addressing global environmental crises and achieving long-term resilience. Policymakers, businesses, and communities must collaborate to overcome barriers and leverage opportunities, ensuring a



sustainable future for all. Emerging trends such as green hydrogen and smart agriculture further highlight the innovative potential of the green economy.

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**Polienko K.A.**

### **THE ROLE OF STATISTICS IN ECONOMICS**

*Language Advisor – Lect. Myrhorod V. O.*

*Scientific Advisor – Lect. Myrhorod V. O.*

Statistics plays a central role in the field of economics, serving as a fundamental tool for understanding complex economic phenomena and making informed decisions. By collecting, analyzing, and interpreting numerical data, economists can draw conclusions about economic trends, policies, and behavior. At their core, statistics provide the methods and techniques needed to effectively organize economic data. Economic activity generates a wealth of information, from employment and inflation figures to consumer spending and the balance of trade. Without statistical tools, this data would remain chaotic and difficult to analyze.

Using descriptive statistics, economists can summarize large data sets and identify trends that are crucial for assessing the health of an economy.

One of the main applications of statistics in economics is economic forecasting. Economists rely on statistical models considering historical data to predict future economic conditions. For example, time series analysis helps economists study past trends. Accurate forecasts help businesses and governments make strategic decisions, such as investing in new projects or adjusting monetary policy, which ultimately contributes to economic stability and growth. Statistics also play an important role in evaluating economic policies. Policymakers use statistical analysis to evaluate their effectiveness. For example, during the introducing a new tax policy, it is important to analyze how it affects revenue generation and economic behavior. Regression analysis helps economists assess how different variables behave and the overall effects of policy changes. This empirical evidence-based approach helps ensure not only a good basis for policy, but also its adaptability.

Statistics makes it easier to understand economic inequality and social problems. By thinking about data on income distribution and wealth gaps, economists can identify the underlying causes of economic inequality and propose various changes.

Statistics also helps with international comparisons and cooperation. The role of statistics in economics influences the field of behavioral economics, where it helps to understand how psychological factors influence economic decisions. The globalization of economies requires a statistical framework to manage economic interactions. Thus, expanding statistical capabilities not only helps improve domestic policies but also strengthens international economic relations. In this world, the role of statistics in economics will be crucial (Mankiw, 2014).

Furthermore, statistics enable economists to conduct rigorous empirical research that uncovers the relationships between various economic variables. For instance, econometric techniques allow researchers to isolate the effects of interest

rates on investment, or unemployment rates on consumer spending, thereby providing a clearer understanding of economic dynamics. These insights help inform public debate and shape discourse around crucial economic issues, ultimately guiding actionable solutions. Another vital application of statistics is economics manifests in the analysis of labor markets. By examining labor force participation rates, wage trends, and employment patterns through statistical lenses, economists can diagnose labor market conditions and propose targeted interventions. Such analyses inform policies aimed at job creation and workforce development, directly impacting economic resilience and social welfare.

Lastly, the constant evolution of statistical methodologies, including machine learning and big data analytics, enhances economists' capabilities. These advanced techniques allow for more sophisticated modeling of economic phenomena, facilitating more accurate predictions and richer insights into complex patterns. As data becomes increasingly abundant, the effective utilization of these statistical innovations will be paramount in understanding and responding to economic challenges on both national and global stages (Keller, 2014).

In addition to labor market analysis, statistics play a crucial role in evaluating macroeconomic policies. Researchers employ econometric models to assess the impacts of fiscal and monetary policies on economic growth, inflation, and overall stability. By rigorously testing hypotheses and analyzing historical data, economists can determine the effectiveness of various interventions, offering evidence-based recommendations to policymakers. This empirical foundation is essential for crafting sustainable economic strategies that foster long-term growth while mitigating adverse effects.

Moreover, the study of inequality and poverty dynamics benefits significantly from statistical methods. By analyzing income distribution, wealth gaps, and social mobility through quantitative techniques, economists can identify patterns and propose equitable solutions. These analyses inform social policies aimed at reducing inequality, ultimately driving inclusive economic development

that enhances the quality of life for marginalized populations. As the economic landscape becomes increasingly complex, the integration of interdisciplinary approaches, including behavioral economics and data science, will reshape traditional economic thought. The convergence of these fields with robust statistical tools enables a more nuanced understanding of human behavior in economic contexts. Consequently, this holistic perspective will strengthen the analytical framework that underpins effective policy-making in an ever-evolving global economy (Wooldridge, 2010).

Additionally, the advent of big data has transformed the way economists approach their analyses. With access to vast amounts of information from various sources, including social media, transaction records, and demographic databases, researchers can uncover insights that were previously hidden. This has led to more accurate modeling of consumer behavior, enabling policymakers to tailor interventions to meet the specific needs of different population segments. Consequently, policy measures can be more effectively aligned with the realities of economic behavior, enhancing their potential impact. Furthermore, the application of machine learning techniques in economic forecasting has emerged as a game changer. By harnessing algorithms that can process and analyze complex datasets, economists can generate predictions with greater precision. This technological advancement not only improves the accuracy of economic models but also facilitates the identification of emerging trends, empowering policymakers to respond proactively rather than reactively.

In conclusion, the synergy between statistics and economics is pivotal for the formulation of robust policy frameworks. As the disciplines evolve, ongoing collaboration among economists, statisticians, and data scientists will be essential in addressing the multifaceted challenges of modern economies. By fostering an environment of research innovation and interdisciplinary dialogue, we can forge a path toward sustainable growth and equitable prosperity for all (Gujarati & Porter, 2009).

Moreover, the integration of big data analytics into economic research has the potential to democratize access to information. Previously, smaller institutions with limited resources often struggled to compete with larger entities in data collection and analysis. However, the proliferation of open-source tools and platforms has leveled the playing field, allowing a diverse array of researchers to contribute valuable insights. This democratization not only fosters innovation but also enhances the variety of perspectives and solutions that can be applied to economic challenges.

Additionally, the interplay between behavioral economics and data analytics is becoming increasingly salient. By incorporating insights from psychology and sociology into data-driven models, economists can better understand the anomalies in consumer behavior that traditional models may overlook. This holistic approach enables the development of more nuanced policies that consider the complexities of human motivation, ultimately leading to improved economic outcomes. As we look to the future, the role of ethical considerations in data usage will be paramount. Economists and data scientists must navigate the fine line between leveraging data for enhanced understanding and respecting individual privacy rights. Continuous dialogues around data ethics will be essential to ensure that the benefits of big data are realized while maintaining public trust. This balanced approach will be crucial as we harness the power of data to inform policy and drive economic progress ( Stock & Watson, 2015).

In conclusion, statistics is an indispensable component of economics, underpinning the analysis and interpretation of data that inform economic decisions and policies. Through their various applications, statistics improve our understanding of economic dynamics, support effective policymaking, and drive economic progress. As the world continues to change and evolve, the importance of statistical analysis in economics will only grow, making it imperative for economists, businesses, and governments to use data effectively for a better future.

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**Pronin O. S.**

### **DEVELOPING AN INTERNATIONAL STRATEGY FOR BANKING ENTERPRISES**

*Language Advisor – Asst. Prof. Chevychelova O. O.*

In the modern world, financial enterprises are becoming increasingly globalized. Corporations and investors often operate in international markets, requiring reliable banking sector enterprises. Developing a strategy for international expansion can enable banks to meet the demands of various corporations and clients, especially during times of armed conflict in a country. A well-chosen strategy can provide competitive advantages, allowing banks to expand markets, attract new revenue streams, and mitigate risks. This is why a deeper examination of this topic is proposed.

To begin, it is important to understand the concepts of banking sector development and international enterprise development. The development of a banking enterprise is a process of changes that lead an economic entity to transition from one qualitative state to another (Zanora, 2019, p. 72). The international development of a banking enterprise involves expanding the bank's activities beyond its domestic market to international markets (Collinson, 2020, p. 40).

The spread of the process of implementing international activities creates a situation where regulating international relations solely at the state level, i.e., at the level of intergovernmental relations, becomes insufficient. A country must delegate part of its economic governance functions to supranational bodies. In the modern conditions of global economic development, this is essential; otherwise, international economic relations would be chaotic, and the pace of global economic growth would be significantly slower. Such supranational structures include international economic enterprises, bodies of international integration associations (for example, in the EU, these are the Council of the European Union, the European Commission, the European Parliament, and others), and transnational banks, which act as regulators of international economic relations in conjunction with the respective state bodies of a country.

Successful formation and implementation of international development strategies require a comprehensive analysis of all aspects related to the company's operations, including internal and external factors, while considering the company's needs and opportunities in the international market. A company must maintain flexibility and adaptability to conditions, actively implement innovations, and refine its strategy to achieve success in new markets.

Based on the definitions and concepts outlined above, the following conclusions can be drawn. International development of a banking enterprise includes establishing or acquiring branches, offices, or subsidiaries in other countries, providing banking services, and working with clients beyond its home country. International development can help a banking enterprise diversify risks, attract new clients, and increase profits by leveraging opportunities offered by international markets. Additionally, it allows companies to gain access to new sources of financing and sales markets.

International banks play a critical role in ensuring the stability of the global financial system. The financial system enables banks to lend to one another, exchange currencies, make international payments, and perform other financial

tasks that ensure a seamless and accessible financial system. They also play a vital role in facilitating global trade by offering financial assistance to exporters and importers, including loans, payment guarantees, risk mitigation tools, and other services that support the expansion of international trade.

The development of a bank's strategy for entering the international market is the most critical stage in the international expansion of its operations. A properly formulated strategy is a key factor in the bank's success in the chosen market. Modern approaches to developing an international development strategy are based on the fundamental principles of strategic management and banking management.

The main characteristic of this strategy is its focus primarily on the medium- and long-term prospects for the bank's international activities, rather than on improving financial performance in the short term. The choice of strategy for entering the international market is significantly influenced by the legislation of the bank's country of origin and, especially, the country where the future branch will be located. Certain forms of a bank's presence in the international market, such as branches, may be prohibited, or the share of foreign capital participation in a banking institution may be restricted.

Moreover, they contribute significantly to national economic growth by financing infrastructure projects, supporting small and medium-sized enterprises, implementing financial reforms, and initiating measures to promote economic development. Establishing international financial institutions can enhance access to financial services, such as bank accounts, loans, insurance, and investment products, for individuals and companies alike. This is particularly important for countries that have not yet fully developed their financial systems.

International banks encourage global partnerships and teamwork by sharing knowledge, values, and regulations and offering financial support for joint projects and initiatives. This improves the efficiency and security of the global financial system. Thus, the international development of the banking sector affects many



economic and financial factors, including stability, growth, and cooperation among nations.

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**Riznyk I. Ye.**

## **THE TRANSFORMATIVE IMPACT OF DIGITALIZATION ON GLOBAL ECONOMIES AND SOCIETIES**

*Language Advisor – Asst. Prof. Chevychelova O. O.*

The advent of digital technologies has fundamentally transformed economic structures, processes, and interactions globally. Digitalization, which encompasses the integration of digital technologies into all aspects of life, has become a key driver of growth, innovation, and societal change. This paper explores the comprehensive impact of digitalization, focusing on its role in business, labor markets, financial systems, governance, and sustainability.

Digitalization has revolutionized business models by enabling companies to adopt innovative technologies such as cloud computing, artificial intelligence (AI), big data analytics, and blockchain. These technologies facilitate real-time decision-making, optimize supply chains, and enhance customer experiences. E-commerce platforms like Amazon and Alibaba have redefined consumer behavior by offering seamless access to global markets, while digital marketing strategies personalize consumer engagement.

For small and medium enterprises (SMEs), digital tools lower entry barriers and expand market reach. Despite these benefits, the digital divide remains a challenge, as unequal access to technology exacerbates economic disparities between regions and demographics.

The digital economy is reshaping labor markets by creating new job opportunities while displacing traditional roles. Automation and AI have increased efficiency but replaced routine tasks, particularly in manufacturing and service industries. Consequently, there is a pressing need for workforce reskilling and upskilling programs to prepare employees for emerging roles such as data analysts, AI specialists, and digital marketers.

Gig economy platforms, enabled by digitalization, have introduced flexible earning opportunities. However, these platforms often lack job security and benefits, raising concerns about workers' rights and income inequality. Policymakers and businesses must collaborate to ensure fair labor practices in the digital era.

The financial sector has undergone significant changes due to digitalization. Fintech solutions, including mobile banking, peer-to-peer lending, and blockchain technologies, have enhanced financial inclusion and accessibility. Cryptocurrencies like Bitcoin and Ethereum offer decentralized alternatives to traditional monetary systems, enabling borderless transactions.

Digital payment systems such as PayPal, Alipay, and Stripe simplify global commerce, while AI-powered fraud detection enhances security. However, these advancements come with challenges, including regulatory uncertainty, cybersecurity risks, and the potential for market volatility. Governments need regulatory frameworks to balance innovation and consumer protection.

Governments are leveraging digital technologies to improve economic governance and policy implementation. Digital platforms enable efficient tax collection, streamline public services, and reduce corruption. E-government initiatives have transformed citizen-government interactions, enhancing transparency and accessibility.

Digitalization also supports data-driven policy-making, allowing policymakers to analyze economic trends and forecast future developments. However, the increased reliance on data raises concerns about privacy, data security, and ethical governance. Addressing these challenges is essential for fostering trust in digital systems.

Digitalization presents both opportunities and challenges for environmental sustainability. Smart technologies such as IoT-enabled energy management systems and digital monitoring tools optimize resource usage, reducing carbon footprints. The proliferation of telecommuting and virtual collaboration tools further minimizes environmental impact by reducing commuting-related emissions.

Conversely, the energy consumption of data centers and electronic waste generation remain pressing issues. Innovative approaches, such as using renewable energy to power data centers and developing recycling programs for electronic waste, are critical for mitigating these challenges.

Digitalization has significant social and cultural implications. It fosters global connectivity, enabling cultural exchange and collaboration across borders. Social media platforms amplify diverse voices, promoting inclusivity and awareness of global issues. However, the digital landscape also exacerbates cultural homogenization, misinformation, and online harassment.

Education systems are increasingly integrating digital tools, offering online learning platforms, virtual classrooms, and digital resources. These innovations enhance accessibility but also highlight disparities in digital literacy and infrastructure availability.

Digitalization is a transformative force influencing every aspect of society and the economy. Its impact spans business operations, labor markets, financial systems, governance, environmental sustainability, and cultural exchange. While it offers immense opportunities for growth and innovation, it also presents challenges that require collective action from stakeholders. By addressing issues such as

inequality, regulation, and sustainability, digitalization can drive inclusive and equitable progress in the digital age.

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**Semchenko M.O.**

## IMPACT OF GLOBALIZATION ON MODERN ECONOMIES

*Language Advisor – Asst. Prof. Chevychelova O. O.*

Globalization has become one of the defining phenomena of the modern era, profoundly influencing economies worldwide. Characterized by the increasing interdependence of nations through trade, investment, and technology, globalization has reshaped economic landscapes, presenting both opportunities and challenges. This article examines the multifaceted impact of globalization on modern economies, focusing on trade, labor markets, technological advancements, economic disparities, cultural implications, and environmental consequences.

Globalization has significantly enhanced international trade, enabling countries to specialize in the production of goods and services where they have a comparative advantage. This specialization fosters economic efficiency and

stimulates growth. The establishment of global trade organizations, such as the World Trade Organization (WTO), has facilitated smoother trade relations, reducing tariffs and promoting free trade agreements.

The reliance on global supply chains, however, exposes economies to risks. Disruptions caused by geopolitical tensions, natural disasters, or pandemics can have cascading effects. For instance, the COVID-19 pandemic revealed vulnerabilities in global supply networks, prompting discussions on reshoring and diversifying supply chains. Additionally, trade imbalances between countries often result in political tensions, underscoring the need for fair and equitable trade policies.

The integration of global markets has created new employment opportunities, particularly in emerging economies, where industries such as manufacturing and services have flourished. Foreign direct investment (FDI) from developed countries has spurred industrial growth and technology transfer in these regions. This has been instrumental in poverty alleviation and improving living standards in many parts of the world.

Conversely, globalization has contributed to job displacement in developed nations, particularly in industries susceptible to outsourcing. The decline of traditional manufacturing jobs has led to socioeconomic challenges, including regional economic stagnation and rising unemployment in affected areas. The shift in demand for high-skilled labor has widened income inequality, emphasizing the need for reskilling and upskilling initiatives to equip workers for the evolving economic landscape. Governments must invest in education and training programs to ensure a more equitable transition.

Globalization has accelerated the diffusion of technology and innovation across borders. Collaborative research and development initiatives among countries have led to breakthroughs in various fields, including healthcare, renewable energy, and information technology. Multinational corporations play a pivotal role in driving innovation by establishing research hubs and fostering knowledge exchange.

However, the digital divide remains a significant challenge. Unequal access to technology and digital infrastructure limits the participation of certain regions in the global economy, exacerbating existing inequalities. Addressing this gap is crucial for ensuring inclusive economic growth and fostering global collaboration.

While globalization has lifted millions out of poverty, it has also exacerbated economic disparities between and within nations. Developed countries often benefit disproportionately from globalization due to their advanced infrastructure, access to capital, and strong institutional frameworks. In contrast, underdeveloped economies struggle to compete, leading to persistent poverty and social inequality.

The rise of global monopolies further compounds inequality. A handful of multinational corporations dominate industries, amassing significant economic power and influencing market dynamics. This concentration of power poses challenges to fair competition and equitable wealth distribution. Policymakers must address these imbalances through equitable trade policies, progressive taxation, and international cooperation.

Globalization has facilitated cultural exchange, fostering greater understanding and appreciation of diverse traditions and values. The proliferation of global media and the internet has enabled the dissemination of ideas, art, and knowledge across borders. However, cultural homogenization, driven by the dominance of Western cultural products, often undermines local traditions and identities.

Efforts to promote cultural preservation and diversity are essential to counteract these effects. Governments and organizations must support initiatives that celebrate and safeguard indigenous cultures, languages, and heritage in an increasingly interconnected world.

The rapid expansion of global trade and industrial activities has significant environmental implications. Increased production and transportation contribute to greenhouse gas emissions, deforestation, and resource depletion. Globalization-driven consumerism exacerbates waste generation and environmental degradation.

On the positive side, globalization has also facilitated the spread of environmentally friendly technologies and international collaboration on sustainability initiatives. Agreements such as the Paris Climate Accord demonstrate the potential for collective action to address global environmental challenges. Businesses and governments must prioritize green practices, including sustainable supply chains, renewable energy adoption, and circular economy models.

Globalization has reshaped modern economies, driving trade, innovation, and economic growth while also presenting challenges such as inequality, cultural homogenization, and environmental degradation. As nations navigate the complexities of globalization, fostering inclusive growth and addressing disparities remain critical priorities. Collaboration among governments, businesses, and international organizations is essential for maximizing the benefits of globalization while mitigating its adverse effects. By embracing sustainable practices and equitable policies, the global community can create a more balanced and resilient economic future.

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**Sumtsov B. Ye.**  
**THE ROLE OF CRYPTOCURRENCIES IN THE MODERN ECONOMY  
AND THEIR IMPACT ON TRADE**

*Language Advisor – Asst. Prof. Chevychelova O. O.*

Cryptocurrencies have revolutionized the world of finance. Acting as decentralized digital currencies, they offer an alternative to traditional financial systems using blockchain technology. Since the launch of Bitcoin in 2009, the cryptocurrency market has grown exponentially in both market capitalization and user base. In this article, we will consider the role of cryptocurrencies in the modern economy, their transformative impact on trading practices, and the challenges that accompany their adoption.

Cryptocurrencies such as Bitcoin, Ethereum, and others have gained widespread attention due to their potential to disrupt the traditional banking system. Transactions are becoming faster, safer, and more cost-effective. Additionally, cryptocurrencies can promote financial inclusion by giving the unbanked population access to digital financial services.

The main advantage of cryptocurrencies is their global availability. Unlike traditional currencies, they are not restricted by barriers, which in my opinion is very convenient. This allows businesses and individuals to conduct transactions seamlessly across the globe. For example, money transfers using cryptocurrencies can be processed in minutes compared to days or weeks in traditional banking systems.

Blockchain technology, the foundation of cryptocurrencies, is driving innovation in various sectors outside of finance. For example, smart contracts allow agreements to be automated without the need for intermediaries, reducing costs and increasing efficiency. In supply chain management, blockchain provides transparency by recording every step of a product's movement. These features highlight the growing economic importance of cryptocurrencies.

Cryptocurrency trading has become one of the most dynamic areas in the financial sector. Unlike traditional stock exchanges that operate at set hours,



cryptocurrency markets operate 24/7, providing traders with constant opportunities. This continuous nature attracts both professional and amateur traders, as they can make trades at any time. But you can also see that cryptocurrency in trading is quite similar to stock markets.

One of the key factors in cryptocurrency trading is its volatility. For example, Bitcoin experienced huge price fluctuations between 2017 and 2021, its value rose from \$1,000 to over \$60,000, and then fell again. These fluctuations create opportunities for significant profits, but also carry the risk of significant losses. Also, when considering cryptocurrency trading, it is more convenient to open swing positions rather than day trading.

Cryptocurrency derivatives such as futures, options, and leveraged tokens have further expanded trading opportunities. These instruments allow investors to hedge risks and speculate on future price movements. Platforms such as Binance and Coinbase have played a critical role in making these instruments available to both retail and institutional investors, increasing liquidity and expanding market participation.

Decentralized finance (DeFi) is another growing trend that uses cryptocurrencies for peer-to-peer financial services, including lending, borrowing, and earning interest. Built on blockchain, DeFi platforms bypass traditional financial institutions by making trading and investing activities more inclusive and efficient.

Despite the benefits, cryptocurrencies face significant challenges that hinder their full adoption. Regulatory uncertainty is one of the most pressing issues. Governments around the world are struggling to define cryptocurrencies: are they assets, currencies, or commodities? The lack of clear regulation exposes traders and investors to potential legal risks.

Environmental concerns are another major concern. For example, Bitcoin mining requires a huge amount of energy due to the proof-of-work mechanism.

Research has shown that Bitcoin's energy consumption rivals that of small countries, which calls into question its sustainability.

Furthermore, the cryptocurrency market is vulnerable to cyberattacks and fraud. Numerous cases of exchange hacks and phishing scams have resulted in significant financial losses. For example, the Mt. Gox hack in 2014 resulted in the loss of 850,000 bitcoins, highlighting the need for robust security measures. A large number of scammers also make money by releasing "scam projects" that they then manipulate and profit from.

Another risk is market manipulation. The lack of regulation allows some players to artificially inflate or deflate prices, making the market less predictable and trustworthy. This volatility and unpredictability discourages risk-averse investors and raises concerns about the long-term stability of cryptocurrencies.

The future of cryptocurrencies depends largely on how key issues are addressed. Governments and regulators need to create clear and supportive structures that will encourage innovation while protecting investors. Many countries are already taking steps in this direction. For example, El Salvador became the first country to accept Bitcoin as legal tender, sparking debate about the potential integration of cryptocurrencies into mainstream economies.

Technological advances are also playing a critical role. The transition from energy-intensive proof-of-work systems to more sustainable proof-of-stake mechanisms, as seen in Ethereum's recent upgrades, is a positive step towards addressing environmental concerns.

In addition, the integration of artificial intelligence and machine learning into trading algorithms could further improve the efficiency and profitability of cryptocurrency trading. As blockchain technology continues to evolve, it is likely to open up new use cases that could cement cryptocurrencies as a vital component of the global economy.

In conclusion, cryptocurrencies are fundamentally reshaping the modern economy and trade. They offer unparalleled opportunities for global accessibility,

financial inclusion, and technological innovation while introducing new challenges such as regulatory uncertainty, environmental concerns, and cybersecurity risks. For cryptocurrencies to achieve their full potential, governments, businesses, and stakeholders must collaborate to establish sustainable practices and supportive frameworks. If these hurdles are overcome, cryptocurrencies could transform global commerce, streamline transactions, and define the future of the digital economy.

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# INFORMATION TECHNOLOGIES

**Aleksandrov M. S.**

## **PYTHON AS A PROGRAMMING LANGUAGE**

*Language Advisor – Senior Lecturer Lysenkova T.M*

Python is a high-level, interpreted object-oriented programming language. It was created by Guido van Rossum in 1990. The first release of the system (version 0.9) took place in 1991. Python is actively used in web development, data analysis, machine learning, process automation, game development, and many other industries. The language was named after one of the comic actors' groups, namely “Monty Python”.

### Advantages of the Python:

Simple and readable syntax: Python allows you to write clear code that is easy to learn for beginners who are learning a programming language for the first time.

Cross-platform: Python runs on a variety of operating systems (Windows, macOS, Linux, etc.).

Interpretable language: Python code is executed without the need for compilation, which simplifies program development and testing.

Power of the language: Python attracts developers from all over the world; it is used by such companies as Google, NASA, Microsoft, etc.

Large community: Due to its popularity, Python has an active community that creates many additional libraries and resources for learning and practicing.

### Disadvantages of Python:

Slow execution speed: Python is slower than compiled languages

Limited use of Python for mobile development: it is not very popular for people to use it to create mobile applications.

Memory consumption: Python can use much more memory due to dynamic typing.

The text of Python programs:

A Python program consists of a sequence of commands for data input, computations, data manipulations, and output. Typically, simple commands (operators) are written one per line. In complex structures, spaces or indentation at the beginning of the line play a significant role.

Create and edit programs in Python:

Python programs are created as text files with a *.py* extension (e.g., *my\_program.py*).

Using integrated development environments (IDEs) provides syntax highlighting, highlights the program's structure, and simplifies debugging.

Use of Python:

Web development:

In web development, Python is used because of the frameworks that simplify the creation of complex web applications that provide security, scalability, and ease of development.

Gaming industry:

Using a special library in Python, you can create your own but simple games. Python is also used to write some game logic in large projects.

Software development:

Python is used to create desktop applications, thanks to libraries that provide tools for creating a graphical user interface (GUI).

Data types and structures:

Variables and data types: In Python, variables are used to store data of various types, such as integers, fractions, text strings, and boolean values.

Lists and dictionaries: Lists store structured sets of values that are accessed using indexes.

Dictionaries store information. They are convenient for searching data by unique keys.

Functions: Functions are blocks of code that perform a specific task and are called several times in a program. They make the code more structured and avoid repetition.

Loops: Loops in Python allow you to repeat the execution of certain code several times. For example, a *for loop* is used to iterate over a set of data, and a *while loop* executes code as long as a certain condition is met.

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**Alkema P. A.**  
**THE POSSIBILITIES OF MOBILE APPLICATIONS FOR LEARNING**  
**ENGLISH**  
*Language Advisor – Asst. Prof. Shamray O.V.*

Demand from the non-English-speaking population for English language skills has increased with globalization. The number of English language learners has increased rapidly worldwide, including in Ukraine. Technology has changed every aspect of human life, and language learning is no exception. Technology has ushered in a new era of teaching and learning. It makes learning attractive, flexible and heuristic, and technology also boosts productivity and efficiency.

Many studies on the integration of technology and mobile learning in language learning have focused on school pupils or students. Older learners face more difficulties in learning or improving their English skills. Thus, the aim of this

study is to evaluate mobile English learning applications (application software) and their acquisition possibilities in second language learning.

Duolingo is a free platform for language learning and text translation by the public. Duolingo offers in-depth writing lessons for beginners and oral practice for advanced users. A dictionary function is integrated into the application. Games are integrated into almost every part of the application to encourage learners to learn new words. For example, users earn “experience points” as they progress through the app's learning activities, such as completing a predefined lesson. Skills are considered “learned/acquired” when the user has completed all the lessons associated with the skill. Users earn one point for each correct answer, lose one point for each error, and the lesson is considered successful when they reach 10 points. In addition, Duolingo provides feedback to learners. The application also corrects answers when learners make mistakes in practicing their skills. It also provides useful tips for learners to improve their language skills.

Memrise is another free application that is especially recommended for beginners. Taking its cue from Duolingo, Memrise is designed to stimulate memory with an interactive component, making the learning experience similar to a game. In addition to English vocabulary, Memrise provides an opportunity to learn more about the history and culture of the English language. Memrise applies memory tricks that help learn words more easily, and for each correct answer, the learner receives points that can be compared with those of other users [1].

Anki is still a free platform designed for intermediate and advanced learners. Anki is the Japanese word for “memorize”, and this application is primarily designed for memorizing words, phrases, images and sounds. Like other language apps, Anki uses a flash card system, designed to encourage English learners to make connections, repeat and interpret the cards. During the learning process, Anki determines how well the user has memorized each flash card, and does not re-list those already known. With Anki, you can learn English vocabulary, grammar and syntax. [2, p.10]. It can be hard to find subtitled content that's fun or entertaining.

Because it's so much more effective than traditional study methods, you can either dramatically reduce the time you spend studying, or dramatically increase the number of things you learn.

Voice Tube, as the name suggests, is an application that enables users to learn English via YouTube videos. With over 4 million users worldwide, Voice Tube is a popular English language learning platform, famous for its diverse range of trending YouTube videos. It provides well-subtitled videos from the BBC, CNN, TED Talk and many other different sources, and offers various features such as one-touch dictionary, phrase loop, voice recording and more. It offers a wealth of English-language content with over 15,000 videos.

The application allows the user to systematically review vocabulary and expressions at any time to enhance your learning, and to practice pronunciation through continuous imitation and correction. AI-based pronunciation analysis gives you personalized advice on pronunciation. The app's content is categorized into three levels: beginner, intermediate and advanced. Users can also use keywords to search for learning resources. Learners can pause, fast-forward and rewind videos. Learners can also change subtitle size and audio speed to suit their current learning level. Learners' learning process can be recorded. Application navigation is clearly displayed, and learners can customize their preferred viewing settings. However, this application does not offer evaluation or feedback to users to monitor their learning progress, and offers very limited sharing functions.

There's no doubt that modern technologies offer new ways to enhance the learning process for EFL learners, and with the new generation of pupils and students, language practitioners need to be aware of technology-assisted teaching to facilitate the language learning process. In the modern era, with the constant emergence of new technologies, third-party applications and smartphone functions, further exploration in this area is essential. Future research should also focus on the actual implementation of these smart devices in language classrooms, as well as the



types of activities, resources and applications that trainers consider when using mobile learning.

Smartphone use is having an impact on language learning, because it cuts across disciplines and contexts. Learners are no longer dependent on fixed computers, and can participate in activities that are more closely linked to their personal lives [2, p.12]. The learner is more motivated to acquire knowledge or a skill, if he or she feels that it is useful and relevant to his or her personal life.

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**Asaenko Y. S.**

**NEURONET AUTOTRANSFER ARCHITECTURE ENHANCEMENT**

*Scientific Advisor – Cand. of Tech. Science., Assoc. Prof. Plekhova A. A.*

*Language Advisor – DSc (Education), Prof. Saenko N.V.*

## Introduction

To implement enhancements in the architecture of the Neuronet autotransfer, the following suggestions and recommendations are put forth, considering the Neuronet autotransfer software platform as a heterogeneous distributed system. A system of this nature can be subjected to vertical scaling by increasing the server capacity of the base system. An operating variant of the transport portal, despite the existence of more modern models of it which have already been developed, was

installed on a server based on two Intel Xeon 3.00 GHz processors, 2 GB of RAM, two 7 Gb SCSI hard disks in a hardware RAID array [1, 2]. However, this did not affect the system performance.

#### Summary of the main material

Experimental studies when the server was loaded with the user requests showed that the main disadvantage of the chosen architecture was too little RAM, which is critical in the case of server virtualization. This architecture is vertically scalable, meaning that it allows adding more memory modules and drives. However, such scaling usually has much more limits compared with "horizontal" scaling, which involves adding similar or heterogeneous nodes to a transport portal farm or cluster. At the same time, scaling at the level of virtualization technologies allows for actual growth of resources transparently, according to both the "vertical" scaling model and the "horizontal" model.

Linux Containers protect web applications, and create an environment around each application, which in turn increases the reliability of a system, hence allowing modular design of the virtual machine content. High availability, or in other words, HA stands for High Availability. Too many nodes within the cluster ensure the providing of service in case of failure of one or several servers. A load balancing cluster is based on a principle of operation that involves the distribution of requests through one or more input nodes, which in turn redirect these requests to other computing nodes for processing.

The development of almost any website is aimed at functioning with maximum stability, that is, it is available to absolutely all potential visitors at any moment, but unforeseen situations may also happen that can cause its temporary unavailability.

Scalability is usually split into two areas: vertical scalability – increasing the performance of each component of the system in order to increase the overall performance, and horizontal scalability – breaking the system into smaller structural components and distributing them across separate physical machines (or

groups of them) and/or increasing the number of servers that perform the same function in parallel. Vertical scalability, from a financial point of view, is far from the most attractive solution since the price of servers with a large number of processors always grows almost exponentially with the number of processors. That's why the horizontal approach is the most interesting.

However, vertical scalability has a right to exist, especially in situations where the main role is played not by the financial issue, but by the time and speed of solving the problem. This is dictated by the fact that buying a powerful server is much faster than practically re-developing applications, adapting them to work on a large number of parallel servers. The transport portal architecture was selected in such a way that all components of the system are independent and separated. Therefore, the task of correctly distributing the requests between the available application servers is topical. The same server answers those requests, which involve computation like generation of html pages, although sometimes images and other documents are also generated in runtime. Most often, responses to such requests are generated by scripts written in java, php, or other languages (based on materials from <http://habrahabr.ru/post/15362/>).

All requests go through a balancer, which determines to which server it will send the request for processing. When a request is received from a client, the balancer needs to determine which of the Web servers the request will be forwarded to. The decision-making algorithm is called a balancing method or strategy. A balancer should check a server status and its workload to choose the most capable one. Balancing the problem of session storage often arises because a session is available only on the server that created it. This should be taken into consideration in the request redirection algorithm or an application should store sessions on a separate server or database.

When scaling the system, it's worth considering at the start which of the layers is a "bottleneck" – that is, slower than the rest of the system. The tools, log-based utilities identify the bottleneck database queries from the log of a server in

commercial operation. Databases are very often a bottleneck in modern applications. All the database-related problems are typically divided into two classes: performance – the need to store large amounts of data. Load on the database could be reduced by distributing its load across multiple nodes. In this case, it becomes an acute problem of synchronization between nodes.

### Conclusions

The result is the removal of the contradictions of common cost constraints and the necessary computer resources through the rational organization of client-server technology of the transport process. A kind of a free new niche for relevant developments is the synergistic, informational development of the transportation services market.

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**Barashkov V. S.**  
**5G AND FUTURE COMMUNICATION**  
*Language Advisor – CandSc (Education), Assoc. Prof. Borzenko O. P.*

In a world where digital transformation is rapidly changing our daily habits, work processes and social interactions, 5G technology is becoming one of the most important innovations in the telecommunications industry. As the successor to 4G, the fifth generation of mobile communications promises not only a significant increase in network speed and quality, but also opens the door to the full implementation of technologies limited by the potential of previous network standards.

This new technology promises to radically change the spectrum of digital possibilities, in particular, increasing mobile Internet speeds to levels never seen before, potentially reaching 20 Gbps. This data transfer speed is key for high-definition video streaming, seamless operation of the Internet of Things (IoT), and for the development of areas like telemedicine and autonomous transport systems. The delay in data transmission is reduced to 1 millisecond, which is critically important for implementing technologies that require instant reaction in real-time.

These 5G features have the potential to not only improve existing apps and services, but also radically change the way people interact with the digital world. Faster and more efficient network connection can help transform urban agglomerations into smart cities, where everything from street lighting to public transportation can be integrated and automated to improve efficiency, safety, and quality of life for citizens.

5G also brings new challenges. High network speed and capacity require new security and privacy standards, and increase energy consumption and infrastructure investment requirements. Therefore, the 5G implementation will require not only technological innovations, but also strategic planning and regulation at the national and international levels.

Despite the challenges, the 5G era opens up exciting prospects for innovation and economic growth, offering new opportunities for business, education, health and many other areas, significantly expanding the horizons of possibilities in the digital age.

5G technology represents a new generation of mobile communications, introducing a number of significant technological innovations that provide extraordinary data transfer speeds, minimized delays, and increased network capacity. The main technological foundations of 5G include the use of new radio frequencies, improved network architecture, and advanced signal processing methods.

One of the key features of 5G is the use of a wider range of radio frequencies, in particular millimeter waves (mmWave), which range from 30 and 300 GHz. These high frequencies allow for the transmission of large volumes of data at high speeds, but have a shorter range and are more sensitive to physical interference such as buildings or bad weather. This necessitates a denser placement of base stations to ensure coverage.

5G implements a new network architecture that allows for more flexible management of network resources. One of the main innovations is Network Slicing technology, which allows creating multiple virtual networks from one physical infrastructure. Each slice can be optimized for different traffic types, providing appropriate levels of speed, delay, and reliability for a variety of applications, from mass-market Internet video to critically important medical applications.

Massive MIMO (Multiple Input Multiple Output) and Beamforming are two technologies that significantly improve the efficiency of the 5G network. Massive MIMO involves the use of a large number of transmit and receive antennas at base stations, ensuring simultaneous service of many users on a single frequency without mutual interference. Beamforming allows control of the radio signal direction to maximize the connection quality of each individual device, significantly increasing the efficiency of the radio spectrum use and improving coverage.

The implementation of artificial intelligence and machine learning into 5G network management plays a key role in increasing its efficiency and automation. These technologies allow networks to self-learn and adapt to operating conditions, ensuring optimal resource allocation and predicting network service needs.

These technological foundations create the basis for the global 5G implementation, which will not only change the way we use mobile networks, but also offer new opportunities for the development of intelligent systems in all areas of life.

5G technology opens a new era in the world of digital communications and innovation, impacting many aspects of society, from industry and technology to culture and everyday life. Its implementation promises not only to improve mobile communication technologies, but also to radically change the way we interact with information and with each other.

5G will contribute to significant economic efficiency gains by increasing productivity, reducing costs and creating new opportunities for enterprises. In particular, 5G-based technologies will be able to revolutionize industries such as logistics, manufacturing, education, healthcare, finance, and even agro-industrial complex, bringing innovations that will change production chains, logistics, and the distribution of goods and services.

Thus, the 5G era promises to open up new possibilities and improve the quality of life on the planet by offering unprecedented access to information and resources.

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**Benzionovich M. O.**

### **ARTIFICIAL INTELLIGENCE IN OUR LIVES**

*Scientific Advisor – Cand. of Pedagogic Sciences, Assoc. Prof. Rudenko N.V.  
Language Advisor – Cand. of Pedagogic Sciences, Assoc. Prof. Rudenko N.V.*

In the modern scientific space, artificial intelligence is being studied more and more actively, and, as a result, there are growing debates about the prospects and risks of its more comprehensive application. Highlighting the main problems of integrating artificial intelligence into the space of human society that may arise shortly, he also outlines possible ways to mitigate them, if not prevent them.

Generative artificial intelligence is developing rapidly and will soon become ubiquitous in everyday life, making people more productive and helping to solve complex problems while creating new legal and ethical challenges.



There are many benefits of AI, and people are already seeing AI at work. When you type a text message or email, phones, and computers, use predictive text to predict what words will come next. AI can now 'join' meetings, provide a meeting summary, and assign action items. Similarly, before committing to watching a long video or reading an article, AI can provide an overview, allowing people to determine whether they want to take the time to watch it in its entirety or not.

AI can also help break down barriers. AI can already translate languages, and it can even translate conversations in real-time. In a recent presentation, Shaffer showed an AI-powered video where he appeared to speak Mandarin, Hindi, and German.

As for the potential dangers, they also exist. This rapidly evolving technology may create legal and ethical issues that must be addressed. Deepfake videos can impersonate a person and give the impression that they are saying things they have never said or done things they have not done. Artificial intelligence can now imitate the voice. There are examples of the voices of many celebrities. And this is a problem. Fraudsters already pretend to be family members in distress to fool people. The fraud can be even more realistic with the use of deepfake technology.

Artificial intelligence can also be enhanced in warfare, potentially saving and taking lives. There is evidence of this, with the US Defense Advanced Research Projects Agency reporting in 2020 that an AI algorithm defeated a human pilot in a simulated air battle every time in five training missions.

The AI system was the best pilot because it did things average pilots would not do. The pilot had an instinct: 'This is too dangerous,' and they are trained to do things a certain way. If a fighter pilot makes a mistake, he dies. If the AI makes a mistake, the AI doesn't die. This cost function is entirely different: a \$1 billion aircraft instead of a pilot's life.

This raises three critical questions for the future of humanity: What foundations will be laid in AI, and how will they relate? To what extent will AI be able to change them?

The third question is believed to be the most important because, in the end, AI can get out of control, and it is unlikely that it will be focused on values generally considered higher in the human race but are not usually followed.

There is also a lot of talk about introducing artificial intelligence (AI) in education, but there are advantages and challenges, so the question of its necessity is much debated. However, most experts agree that AI can significantly improve the quality of education by making it more adaptive, inclusive, and personalized.

Artificial intelligence can significantly improve the quality of education by making it more efficient, accessible, and adaptable to the needs of different learners. However, to maximize the benefits, it is essential to balance technology use with human teachers' participation, focusing on ethical and social aspects. AI in education should complement the human factor, not replace it.

So, what is the main difference between humans and artificial intelligence? Of course, it's about motivation. It is the motivation that gives quality to actions. As long as AI is not motivated, it remains a tool (Литвин, 2009).

Summing up, the following conclusions can be drawn. It is necessary to create a unified system of concepts and a multidimensional worldview that combines humanitarian and natural science knowledge, as the world is indivisible, and the division into disciplines was introduced only for the convenience of learning. Otherwise, there is a risk that technical 'servants' will surpass their 'masters,' many of whom prefer to remain in ignorance and, getting out of control, will become masters of those who used to control them. It is not for nothing that Hegel once remarked that significant events and personalities in world history repeat themselves twice: the first time as a tragedy and the second time as a farce.

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**Bielikova D. S.**

### **ARTIFICIAL INTELLIGENCE:**

#### **A CHANCE FOR THE FUTURE OR A DANGER?**

*Scientific Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*

*Language Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*

Artificial intelligence is a potential assistant in the modern world, so it is essential to understand the purpose and use of AI.

Artificial intelligence (AI) as a concept began to develop in the mid-20th century. In 1956, the term ‘artificial intelligence’ was first coined at a conference organized by John McCarthy, Marvin Minsky, Nathan Rochester, and others. This conference is considered to be the beginning of active research in AI.

However, ideas related to the automation of thinking and problem-solving had emerged even before that. For example, Alan Turing's work in the 1930s laid the theoretical foundation for computing and machine intelligence.

Artificial intelligence (AI) is used in a variety of industries and for a multitude of purposes. Here are some of the main areas of its application:

1. Process automation: helps automate routine tasks, which reduces costs and increases efficiency.
2. Data processing: analyzing large amounts of data and identifying patterns and trends useful for decision-making.
3. Machine learning: AI learns from data, improving its performance over time without manual programming.
4. Prediction: used to predict future events in finance, marketing, and healthcare industries.

5. Natural language processing: AI technologies, such as chatbots and virtual assistants, enable creating systems to understand and generate text in natural languages.

6. Computer vision is used for image and video recognition, which is used in security, medicine, and the automotive industry (e.g., in autonomous driving systems).

7. Recommender systems: AI helps to create personalized recommendations on services such as Netflix, Amazon, and Spotify.

8. Games and entertainment: AI creates more complex and realistic game characters and scenarios.

9. Medicine: AI helps diagnose diseases, analyze medical images, and develop individualized treatment plans.

10. Scientific research accelerates the discovery and analysis process in various scientific disciplines.

These examples show how AI can improve efficiency, enhance the quality of services, and open up new opportunities in various areas of life.

Considering these examples, we can draw certain conclusions about the benefits and dangers of artificial intelligence.

As for the dangers, they include: 1) information leakage, because as well as the AI coding system protects our data, it can also fail; 2) distortion of information (Fake news), as artificial intelligence generates information for positive human needs and negative ones. In recent years, more and more false information has been created by AI. It can make videos, photos, texts, speeches, and even speak in voice; 3) malicious applications, where AI can be used in cybercrime, for example, to create automated attacks or hack systems. It's important to remember that many of these dangers can be mitigated through proper regulation, ethical standards, and a responsible approach to developing and implementing AI technologies.

But at the same time, it is impossible to talk only about negative use cases without mentioning positive ones.

1. Elementary: It helps knowledge seekers find specific material with quick access and answers several questions. School students sometimes overuse the assistant, but if you use it in moderation, you can benefit more.

2. Faster development of new drugs. When developing a drug, scientists go through several stages. The longest stage is identifying side effects. The use of artificial intelligence can help speed up this process. Unfortunately, this process has not gained sufficient momentum.

3. The most elementary advantage of AI is communication with the consumer. All these chatbots that communicate with us from various manufacturers' websites are a replacement for ordinary managers (Савченко, Синельніков, 2017).

So, having examined artificial intelligence from different angles, we have to draw ambiguous conclusions about the benefits and threats of this development. Namely, AI is a powerful tool that can improve productivity and quality of life. Still, at the same time, its implementation should be justified and ethically balanced to avoid possible negative consequences.

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**Bilyk A. D.**

### **ADVANTAGES OF AZURE SEARCH INDEX OVER TRADITIONAL RELATIONAL DATABASES IN INFORMATION SEARCH TASKS**

*Language Advisor – CandSc (Education), Assoc. Prof. Borzenko O. P.*

Today, in the context of the rapid development of digital technologies and innovative solutions, organizations and companies need effective tools for

processing and searching information. Relational databases have long been the primary means of storing and processing data, but new user needs are forcing a review of traditional approaches. New services such as Azure Search Index are coming to the forefront, offering alternative methods for solving problems associated with searching large volumes of information.

Relational databases are effective for many types of queries, but they have a number of limitations when solving information search problems. The main problem is the need to create complex SQL queries to search for specific information. Relational models work with tabular data, making it difficult to search through the unstructured or semi-structured data often found in modern systems. Databases such as MySQL, PostgreSQL, and SQL Server are built on the principles of the relational data model developed in the 1970s (Wikipedia, 2024).

This model is based on structured data stored in tables, where each record has a clearly defined structure. Such databases are great for working with tabular data and queries that can be described in SQL (Structured Query Language) (Вікіпедія, 2024).

But relational full-text search databases have limited scalability, dependency on table structure, and less efficiency in working with large volumes of unstructured data.

Unlike relational databases, Azure Search Index provides solutions that significantly simplify search processes across large and complex data sets. This service is a fully managed search platform that provides fast and scalable search due to large data volumes. Azure Search offers different types of search functions specifically designed for efficient processing of text data, intelligent search, and other features not supported by traditional relational databases (Learn Microsoft, 2024).

One of the key benefits of Azure Search Index is its ability to process unstructured and semi-structured data, which is especially important in modern world, where most information is stored in the form of text documents, messages,

emails, and web pages. Traditional relational databases are designed to work with clearly structured data, such as tables, but do not work as efficiently with similar formats.

Azure Search provides powerful tools for searching text information with full-text search, synonym search, relevance search, and other parameters. For example, "The Key Phrase Extraction skill evaluates unstructured text, and for each record, returns a list of key phrases. This skill uses the Key Phrase machine learning models provided by Azure AI Language" (Learn Microsoft, 2024). So, users can enter queries in a regular form, and the system automatically analyzes the text, detects keywords, and provides results most suitable for the query. This allows users to find the necessary information much faster and more accurately than using relational databases.

In addition, Azure Search has AI integration tools that allow it to further analyze text and provide users with more accurate search results. Relational databases don't have such capabilities without additional complex setup.

Relational databases remain an important technology in the world of information systems. They provide a structured and reliable way to store and manage data, providing high reliability for processing structured queries.

*Table 1. Advantages of Azure Search Index over traditional databases in information search*

<b>Criterion</b>	<b>Azure Search Index</b>	<b>Relational databases</b>
<b>Data type</b>	Support for unstructured and semi-structured data	Focus on structured tabular data
<b>Scalability</b>	Easy scaling via cloud services	Requires additional infrastructure for expansion
<b>Search functions</b>	Full-text search,	Search via SQL

	relevance, synonyms, filters	queries, limited capabilities
<b>Performance</b>	High speed search in large data sets	Reduced performance with complex queries
<b>Search algorithms</b>	Search by synonyms, morphology processing	No complex text search algorithms
<b>User-friendly</b>	Offers advanced customization and integration with other services	Requires development of SQL queries for search
<b>Result relevance</b>	Automatic ranking by relevance	No support for ranking results
<b>Intellectual capabilities</b>	Morphological search, multilingualism, context analysis	No intellectual capabilities
<b>Flexibility</b>	Ability to customize for different data formats	Limited work with unstructured data
<b>Artificial intelligence integration</b>	AI support to improve search quality	No AI

However, unlike Azure Search, relational databases are limited in their ability to work with unstructured data and search tasks that require intelligent text processing. Azure Search provides modern search solutions, allowing you to process large volumes of information faster and more efficiently using cloud technologies, making it an indispensable tool in many modern business scenarios.



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**Filipiev Ye. S.**

**AI-POWERED LANGUAGE LEARNING: INNOVATIONS,  
CHALLENGES AND OPPORTUNITIES**

*Language Advisor – Senior Lecturer Ivanova I.L.*

Artificial intelligence (AI) is rapidly becoming a transformative force in nearly every aspect of our lives, and education is no exception. One of the most exciting areas where AI is making an impact is language learning. Mastering a new language has always been a challenging yet rewarding process, and AI is revolutionizing the way we approach it. From instant translations to highly personalized learning experiences, AI offers a wide range of tools that cater to individual needs and learning styles. But how exactly is AI influencing the process of language acquisition? This article aims to explore the role played by AI in language learning, its advantages, its limitations, and what the future might hold for AI-driven education.

At the forefront of AI's impact on language learning are automated translators and language-learning apps. For example, Google Translate, Reverso, and Duolingo have become household names, offering users the ability to translate text almost instantaneously or engage in interactive lessons that help build vocabulary, grammar, and comprehension skills. These tools are not only widely accessible but are also designed to be user-friendly, which makes language learning more approachable for people of all ages and backgrounds. The convenience factor is enormous—no longer do learners need to attend traditional classes at set times. With AI-powered apps, learning can happen anytime and anywhere, whether during a daily commute or in the comfort of home.

However, the role of AI in language learning extends far beyond simple translation or vocabulary quizzes. One of the most revolutionary aspects of AI in this field is its ability to create highly personalized learning experiences. Unlike traditional methods that often rely on a one-size-fits-all approach, AI can analyze a student's progress and tailor lessons to suit their individual strengths and weaknesses. For example, if a student struggles with verb conjugations but excels in listening comprehension, the AI can adjust the curriculum to focus more on the areas that need improvement, while not neglecting the areas in which the student is already proficient. This adaptive learning approach not only keeps learners engaged but also ensures that they are continually challenged at an appropriate level, leading to faster and more effective progress.

Furthermore, AI offers new and exciting ways to practice speaking a language, which is often considered one of the most difficult aspects of language learning. Traditionally, speaking practice required finding a conversation partner, ideally a native speaker, or attending classes with an instructor. Today, AI provides virtual conversation partners in the form of chatbots and voice recognition systems that simulate real-life interactions. These tools allow learners to practice conversations in real time, engaging in dialogues that mimic real-world situations, such as ordering food at a restaurant or asking for directions. The advantage of

these AI-driven conversations is that they provide a safe, non-judgmental environment for learners to make mistakes, learn from them, and build confidence before speaking with actual people.

In addition to improving speaking skills, AI-based technologies are helping learners fine-tune their pronunciation. This is particularly important because even small errors in pronunciation can hinder effective communication. Some AI-driven apps are equipped with voice recognition technology that listens to the way a learner pronounces words and provides immediate feedback. This allows users to adjust their pronunciation until it more closely resembles that of native speakers. Moreover, these apps often use speech synthesis technology to provide examples of correct pronunciation, which learners can mimic. Over time, this kind of practice can significantly improve a learner's spoken fluency.

Grammar correction is another area where AI excels. Whether a learner is composing a sentence or writing a longer text, AI can offer instant suggestions on how to improve grammar, sentence structure, and even style. This is especially useful for beginners who may not yet have a firm grasp of complex grammatical rules. By receiving real-time feedback, learners can quickly identify and correct mistakes, helping them internalize the rules of the language more effectively. This process of immediate correction and reinforcement accelerates learning and leads to greater accuracy in both spoken and written communication.

However, while AI offers many advantages, it is important to recognize that it also has its limitations. One of the main drawbacks of relying too heavily on AI in language learning is that it struggles with cultural and contextual nuances. Language is deeply intertwined with culture, and many expressions, idioms, and jokes require an understanding of the cultural context in which they are used. Automated translators, no matter how advanced, often fail to accurately interpret these subtleties. For example, an idiom in one language may make no sense when directly translated into another, and AI may struggle to provide an appropriate equivalent. This limitation highlights the importance of human involvement in

language learning, particularly when it comes to understanding cultural differences and the deeper meanings behind words and phrases.

Another concern with AI in language learning is the potential for learners to become overly dependent on technology. While AI tools are undoubtedly useful, they should not replace traditional methods of learning, especially when it comes to human interaction. Language is a social construct, and the best way to truly master it is through real-life conversations with other people. AI can simulate these conversations to a certain extent, but it cannot replicate the spontaneity, emotional nuance, or cultural richness of real human interaction. Thus, while AI is an excellent tool for practicing language skills, it is important for learners to balance their use of technology with opportunities for live communication with native speakers.

Despite these limitations, the future of AI in language learning looks incredibly promising. As AI technology continues to evolve, we can expect to see even more sophisticated tools that can better understand and interpret the complexities of human language. For example, advancements in natural language processing (NLP) and machine learning could lead to more accurate translations and better comprehension of cultural nuances. Additionally, future AI systems could be designed to facilitate more immersive language-learning experiences, perhaps through virtual reality environments where learners can practice real-world conversations in a fully simulated setting. This could offer learners the best of both worlds: the convenience and personalization of AI-driven learning, combined with the depth and richness of real-life interaction.

In conclusion, it should be noted that artificial intelligence is revolutionizing the way we learn foreign languages, offering a range of tools that make the process more accessible, personalized, and efficient. From automated translators to adaptive learning programs and virtual conversation partners, AI is helping learners overcome many of the traditional barriers to language acquisition. However, it is important to recognize that AI is not a perfect substitute for human interaction or

cultural understanding. As learners, we should embrace the opportunities AI provides but also remain mindful of the need for real-world practice and cultural immersion. With the right balance, AI can be a powerful ally in our journey to mastering new languages.

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**Frizel V. V.**

### **THE IMPACT OF DIGITALIZATION ON THE LABOR MARKET: NEW PROFESSIONS AND SKILLS**

*Language Advisor – Asst. Prof. Chevychelova O. O.*

Digitalization, driven by rapid advancements in technology, is fundamentally reshaping the labour market. This transformation presents both challenges and opportunities, creating new professions while simultaneously demanding a shift in the skillset of existing roles. Understanding these changes is crucial for students navigating the evolving landscape of work and preparing for a future career.

Digitalization has birthed entirely new fields and professions that were unimaginable just a few decades ago. These emerging roles often revolve around data, automation, and online platforms. Data scientists and analysts, for example, are in high demand due to the explosion of data, and they are skilled in extracting insights, identifying patterns, and making data-driven decisions. These roles require expertise in statistical analysis, programming languages like Python and R, and

data visualization techniques. As AI continues to permeate various industries, specialists in machine learning, deep learning, natural language processing, and computer vision are becoming increasingly sought after. These AI specialists develop and implement algorithms to automate tasks, improve efficiency, and create innovative solutions. The shift towards cloud-based infrastructure has also created a need for professionals who can design, manage, and maintain cloud systems. Expertise in cloud platforms such as AWS, Azure, and Google Cloud, as well as knowledge of networking, security, and DevOps practices, are essential in cloud computing roles. With the increasing reliance on digital systems, cybersecurity threats are on the rise, making cybersecurity analysts crucial for protecting sensitive data and systems from cyber attacks. This profession requires expertise in network security, ethical hacking, and incident response. UX/UI designers, on the other hand, focus on creating user-friendly and engaging digital products and services, combining design skills, an understanding of user behaviour, and technical knowledge of web development. Social media managers and digital marketers help businesses leverage social media and digital platforms to build brand awareness, engage customers, and drive online sales.

The rapid pace of digital transformation is also influencing traditional industries. In sectors such as healthcare, education, and manufacturing, digitalization is improving efficiency and opening up new avenues for employment. For example, in healthcare, telemedicine has become increasingly prevalent, requiring healthcare professionals to adapt to new digital tools and platforms. Additionally, the manufacturing industry is increasingly relying on Industry 4.0 technologies, such as smart factories, robotics, and the Internet of Things (IoT), creating a demand for workers who can manage and maintain these sophisticated systems. This shift is leading to new hybrid roles, combining industry expertise with technical know-how to keep pace with innovation.

Beyond the emergence of new professions, digitalization is also transforming existing roles. Many traditional jobs now require a new set of digital skills to

remain relevant in the evolving workplace. Digital literacy, which includes proficiency in using software applications, navigating the internet, and understanding basic coding concepts, is becoming essential across various professions. The ability to analyse and interpret data is becoming increasingly valuable in fields such as marketing, finance, healthcare, and education. While not every profession requires advanced coding skills, a basic understanding of programming languages can be beneficial in automating tasks and working with data. The rapid pace of technological change demands adaptability and a willingness to continuously learn new skills throughout one's career. Problem-solving and critical thinking are also essential as digitalization often presents complex challenges. Communication and collaboration skills are crucial for working effectively in virtual teams and across departments, with digital tools facilitating these processes.

As businesses evolve and embrace digital tools, the demand for flexibility and cross-disciplinary knowledge continues to grow. For instance, marketing professionals now need to be proficient in digital marketing strategies, data analysis, and content creation. At the same time, roles that were previously considered niche or secondary, such as data privacy officers and digital ethics advisors, are gaining prominence. These positions play a critical role in ensuring that companies navigate the complexities of the digital world responsibly, protecting both the integrity of their data and their customers' privacy. The rise of these new positions demonstrates how industries are not only innovating but also rethinking governance and ethical frameworks within the digital space.

Students entering the workforce must be prepared for a dynamic and constantly evolving labour market. This requires a proactive approach to education and skill development. Embracing lifelong learning, focusing on transferable skills like problem-solving, critical thinking, and communication, gaining practical experience through internships and volunteer opportunities, networking, and staying informed about industry trends will position students for success in the

future of work. By understanding the impact of digitalization and actively developing the necessary skills, students can prepare themselves for the challenges and opportunities of the modern labour market.

In conclusion, the impact of digitalization on the labour market is undeniable, driving the creation of new professions and transforming existing roles. As industries increasingly rely on data, automation, AI, cloud computing, and cybersecurity, the demand for skilled professionals in these areas is rapidly growing. At the same time, digitalization requires existing workers to adapt by acquiring new digital skills, such as data analysis, coding, and digital literacy, to remain competitive. The future labour market will demand individuals who are adaptable, continuously learning, and capable of navigating the ever-changing technological landscape. For students entering this dynamic workforce, focusing on acquiring transferable skills, gaining practical experience, and staying informed about technological advancements will be crucial to ensuring success in an increasingly digital world. By understanding the impact of digitalization and actively developing the necessary skills, students can prepare themselves for the challenges and opportunities of the modern labour market.

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[require-digital-skills-one-third-of-workers-have-low-or-no-digital-skills-due-to-historic-underinvestment-structural-inequities/](#)

**Harbuz S. I.**

**AGENT-ORIENTED PROGRAMMING**

*Scientific Advisor – Cand. of Tech. Sc., Assoc. Prof. Pronin S. V.*

*Language Advisor – DSc (Education), Prof. Saienko N.V.*

Agent-Oriented Programming (AOP) is a programming paradigm introduced by Yoav Shoham (1990) as a specialization of Object-Oriented Programming (OOP). It conceptualizes computation as a societal interaction among autonomous entities, called agents. An agent is defined by its mental state, consisting of components such as beliefs, capabilities, commitments, and decisions, which are formally represented in an extended modal logic.

The core concepts of AOP are as follows:

**Agents and Mental States:** An agent's mental state is central to its design, encompassing beliefs (what the agent knows or assumes), obligations (commitments to actions or other agents), and capabilities (what it can do).

**Communication:** AOP incorporates the principles of speech act theory, enabling agents to communicate through actions such as informing, requesting, and committing. These interactions rely on specific protocols, ensuring that agents act consistently and adhere to societal norms like honesty and coherence.

**Programming Agents:** Agents are programmed using AOP languages like Jade, which provide constructs for defining mental states, commitments, and communication protocols. This programming involves defining rules under which agents update their beliefs and make new commitments based on received messages and internal states.

**Comparison with OOP.** AOP extends OOP by replacing generic state parameters with mental state components and enabling agents to perform meaningful interactions like offering, promising, or declining. While OOP focuses

on objects and methods, AOP emphasizes agent behaviors governed by logical and societal constraints.

**Applications.** AOP is particularly useful in distributed systems, manufacturing automation, and scenarios requiring autonomous decision-making. For example, in a car manufacturing plant, agents can coordinate tasks like welding and scheduling through automated communication and commitments.

**Challenges and Extensions.** Implementing AOP involves addressing logical consistency, real-time operation, and synchronization among agents. Shoham's AGENT-0 language simplifies these challenges by providing a basic structure, while future enhancements aim to expand its expressiveness and applicability.

In essence, AOP redefines programming by viewing computational entities as intentional agents, offering a robust framework for developing systems that require autonomy, adaptability, and interaction.

**Java Agent Development Framework.** JADE (Java Agent DEvelopment Framework) is a software Framework fully implemented in the Java language. It simplifies the implementation of multi-agent systems through a middleware that complies with the FIPA (Foundation for Intelligent Physical Agents) specifications and through a set of graphical tools that support the debugging and deployment phases. A JADE-based system can be distributed across machines (which not even need to share the same OS) and the configuration can be controlled via a remote GUI. The configuration can be even changed at run-time by moving agents from one machine to another, as and when required. JADE is completely implemented in Java language and the minimal system requirement is the version 5 of JAVA (the run time environment or the JDK).

Besides the agent abstraction, JADE provides a simple yet powerful task execution and composition model, peer to peer agent communication based on the asynchronous message passing paradigm, a yellow pages service supporting publish subscribe discovery mechanism and many other advanced features that facilitates the development of a distributed system.

Thanks to the contribution of the LEAP project, ad hoc versions of JADE exist designed to deploy JADE agents transparently on different Java-oriented environments such as Android devices and J2ME-CLDC MIDP 1.0 devices.

Furthermore, suitable configurations can be specified to run JADE agents in networks characterized by partial connectivity including NAT and firewalls as well as intermittent coverage and IP-address changes (2025).

JADE is a middleware that facilitates the development of multi-agent systems. It includes: a) a runtime environment where JADE agents can “live” and that must be active on a given host before one or more agents can be executed on that host; b) a library of classes that programmers have to/can use (directly or by specializing them) to develop their agents; c) a suite of graphical tools that allows administrating and monitoring the activity of running agents.

#### Containers and Platforms

Each running instance of the JADE runtime environment is called a Container as it can contain several agents. The set of active containers is called a Platform. A single special Main container must always be active in a platform and all other containers register with it as soon as they start. It follows that the first container to start in a platform must be a main container while all other containers must be «normal» (i.e. non-main) containers and must “be told” where to find (host and port) their main container (i.e. the main container to register with).

If another main container is started somewhere in the network it constitutes a different platform to which new normal containers can possibly register. JADE agents are identified by a unique name and, provided they know each other’s name, they can communicate transparently regardless of their actual location: same container, different containers in the same platform or different platforms.

Developers don’t have to know how the JADE runtime environment works. They just need to start it before executing their agents (Caire, 2009).

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**Hetman D. O.**

**ARTIFICIAL INTELLIGENCE: OPPORTUNITIES AND CHALLENGES**

*Scientific Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*  
*Language Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*

Artificial intelligence (AI) is a branch of computer science that focuses on creating intelligent machines or systems capable of performing tasks that usually require human intelligence. AI systems are designed to learn from experience, detect patterns, and make data-based decisions. Artificial intelligence is a branch of computer science that deals with creating software systems that can behave intelligently; it is the scientific engineering of creating intelligent agencies, i.e., systems that can act independently to achieve their goals.

The main goal of artificial intelligence is to create machines or systems that can think and act like humans. Artificial intelligence is developing extremely fast and can perform some tasks more accurately and efficiently than humans.

Every day, artificial intelligence is becoming even more impressive in its abilities, and in some areas, it is even exceeding human capabilities. However, this does not mean it can completely replace human intelligence and warmth. The real value lies in the uniqueness of human experience, feelings, and emotions that are difficult to reproduce in algorithms.

Even the most intelligent AI systems do not have the emotions, intuition, and communication capabilities humans have. And that is why humans are unique.

Artificial intelligence has several potential benefits and dangers.

The main advantages include that it can significantly reduce the number of errors and increase the accuracy of the result when performing various tasks.

With proper programming, errors can be reduced to zero. An example is robotic surgical systems, which can perform complex procedures with incredible precision and accuracy, reducing the risk of human error and increasing patient safety.

Another advantage of artificial intelligence is that it can minimize risks, making it possible to perform dangerous human tasks, such as defusing explosive devices, spaceflight, and exploring the depths of the oceans.

Many studies show that the maximum human productivity is 3-4 hours per day, and people need a break for rest, days off, and a balance between work and personal life. Artificial intelligence, unlike humans, works continuously; robots think faster than humans and can perform several tasks simultaneously, accurately, and quickly. They are used in many companies as chatbots for online customer support.

Some companies are already interacting with their customers with the help of AI-powered digital assistants, thus reducing their staff. Using AI, businesses can replace some staff in various positions with voice or chatbots.

AI has given a powerful impetus to numerous innovations that help people solve complex problems, such as medicine, where diagnostics detect diseases at early stages, or the use of self-driving cars that drive on roads without human intervention, which increases traffic safety.

Artificial intelligence is devoid of emotions and is, therefore, very practical and rational in its decisions, while emotions drive humans to varying degrees (Ковальчук, Ушенко, Угрин, 2022).

However, despite its advantages, AI has several disadvantages.

Firstly, creating machines that can replace human intelligence requires a lot of resources and time, which is expensive for many.

Second, AI cannot think outside the box. It can write essays and articles, but it will be standard and without a soul.

Thirdly, one of the dangers of AI is job cuts. Robots have begun to replace people in various positions, such as production lines, customer support, and others, but it is worth remembering that a person must control these robots.

Finally, with the advent of AI, people do not need to memorize much information or solve various puzzles while doing their work; people tend to put less stress on their brains.

It should be noted that AI can become a severe problem for both the present and the future, as AI works based on previously uploaded data and experience.

So, assuming that artificial intelligence continues to develop, it may be able to perform many everyday tasks better than humans in the future. However, it is essential to remember that humans have inherent qualities that artificial intelligence cannot replace. That is why, while the role of artificial intelligence is growing in everyday life, it is essential to maintain a balance between the use of technology and humans' unique capabilities and values. Technology should help people develop and make their lives easier, not deprive society of the depth of significance of human existence.

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**Ivanova S. I.**  
**THE ROLE OF ARTIFICIAL INTELLIGENCE IN SHAPING OUR  
CONSCIOUSNESS**

*Scientific Advisor – Lecturer Myrhorod V.O.*

*Language Advisor – Lecturer Myrhorod V.O.*

The question of AI's influence on our consciousness is highly relevant today for several reasons, which we will explore in detail.

**Deep Integration of AI in Our Lives.** Virtual personal assistants like Alexa and Siri have become commonplace in households worldwide. They not only streamline daily tasks but also adapt to user habits and preferences, creating a personalized experience that subtly influences user routines and decision-making. Artificial intelligence has permeated almost all areas of our lives, from social media to healthcare. This makes its impact on our thinking, behavior, and worldview inevitable.

**Rapid Technological Development.** AI is evolving at an incredible speed, bringing new challenges and opportunities. Understanding how these technologies influence our consciousness is crucial for adapting to changes and using them for the benefit of humanity. In the healthcare sector, the speed of AI advancement has led to breakthroughs in diagnostics, such as algorithms that can detect certain cancers with higher accuracy than traditional methods. However, these rapid developments also require healthcare providers and patients to adapt quickly, learning how to trust and interpret AI-driven diagnoses while balancing them with human expertise.

**Ethical Dilemmas.** The development of technology raises new ethical questions related to consciousness, responsibility, and the future of humanity (Smith, 2019, p. 102). We must understand how AI affects our identity to make informed decisions about its development and application. Self-driving car technology brings up complex ethical questions, especially concerning decision-making in critical situations. For instance, if a self-driving car must choose between hitting a pedestrian or crashing to avoid them, the AI's decision protocol raises

moral questions about the value of lives. Engineers and ethicists are now working together to address these concerns, recognizing that the outcomes of such decisions will impact public trust and societal acceptance of autonomous technologies.

**Social Consequences.** Artificial intelligence has the potential to alter social structures, the economy, and politics. Understanding its impact on our consciousness will help us anticipate and mitigate potential negative consequences. In the labor market, AI-driven automation is transforming employment patterns by replacing routine jobs with machines and algorithms. As companies increasingly turn to automated solutions, workers in certain industries are facing job insecurity and a shifting sense of self-worth. This shift necessitates discussions around re-skilling programs and social support systems to help workers transition into new roles in an AI-enhanced economy.

Thus, understanding how AI shapes our consciousness is key to creating a more just, safe, and prosperous future. To further analyze the relevance of this topic, let us provide a few specific examples.

Algorithms in social media, based on AI, create «information bubbles, » affecting our views and beliefs (Brown, 2015). The development of robotics and automation may lead to significant changes in the labor market, which in turn affects our self-esteem and sense of personal significance (Thompson, 2021, p. 70). Artificial intelligence is used in disease diagnosis and new drug development, raising questions about the role of humans in medical decision-making. The development of autonomous vehicles requires solutions to complex ethical issues associated with decision-making in critical situations.

**How AI Influences Human Consciousness in Various Areas. Information Filtering and the Formation of «Filter Bubbles».** Consider how social media platforms show news articles based on user preferences. A user frequently engaging with content about environmental issues might receive an abundance of similar articles while seeing fewer views on other topics. This selective exposure can



reinforce existing beliefs and reduce the chances of encountering diverse perspectives.

AI algorithms analyze our online activities, preferences, and search queries to offer personalized content. This creates so-called «filter bubbles, » where we see only information that confirms our beliefs. This mechanism can reinforce biases and limit our understanding of different perspectives. «Filter bubbles» can contribute to social polarization, as people encounter alternative viewpoints less frequently.

Changes in Cognitive Processes. Reliance on AI tools for navigation, such as GPS apps, is one instance where cognitive skills like spatial awareness are impacted. Studies show that frequent GPS use can weaken our natural sense of direction, as we rely on technology for tasks, we once managed ourselves. The constant use of AI for information retrieval and decision-making may reduce our ability to think independently and analyze. AI tools, such as social media, can distract our attention, making it harder to focus on complex tasks. Storing large amounts of information in cloud storage can weaken our need to remember facts.

Impact on Social Interactions. Social media platforms use AI to suggest friends, groups, and events, facilitating connections but also sometimes fostering superficial interactions. A person may feel connected to many people online, yet have limited deep, meaningful relationships, potentially contributing to feelings of loneliness. AI creates new forms of social interactions, such as communication on social media, online gaming, and virtual reality. On the one hand, AI can expand our social circles; on the other, it may lead to feelings of loneliness and isolation from the real world. AI can influence our social norms and expectations, changing the ways we communicate and build relationships.

Artificial intelligence, despite all its advantages, can have unexpected consequences for our mental health. There is increasing evidence that excessive use of AI-related technologies may contribute to the development of disorders such as depression and anxiety. AI-driven health apps track everything from daily steps to

sleep patterns, promoting wellness while sometimes unintentionally increasing anxiety. For example, individuals might become overly focused on achieving daily health goals, leading to stress if these goals are not met.

Artificial intelligence doesn't just alter how we interact with technology—it also impacts our sense of identity and self-worth. Many AI-driven applications encourage constant comparison with others, from curated social media feeds to algorithmically targeted ads that influence consumer behavior and self-image. This phenomenon, often termed the «comparison trap, » can result in feelings of inadequacy, anxiety, and even a distorted self-concept. Studies have shown that individuals who are heavily exposed to AI-driven platforms that emphasize appearance or lifestyle tend to experience heightened body image issues, self-doubt, and lowered self-esteem. Such effects highlight the need for media literacy and self-awareness to counterbalance AI's potential influence on personal identity.

Information overload, specifically the constant stream of information we receive via smartphones and other gadgets, can lead to chronic stress and exhaustion. Thus, it is difficult to concentrate on one task when notifications and new messages constantly appear.

AI can be used to spread fake news and manipulative information, undermining trust in institutions and increasing social anxiety. It is important to understand that AI itself is not a direct cause of mental disorders. However, excessive and unconscious use of technology may exacerbate existing issues or provoke new ones.

As artificial intelligence takes on a more prominent role in decision-making processes — whether through recommendation engines, financial planning tools, or personalized newsfeeds—individual autonomy can be affected. People may begin to overly rely on algorithm-driven advice, allowing technology to subtly shape their choices in ways they may not even recognize. This reliance can diminish personal agency and critical thinking, as individuals are nudged toward decisions that reflect the biases or commercial interests embedded within AI algorithms. To address

these concerns, it is crucial to promote transparent AI systems that allow users to understand the reasoning behind AI-generated suggestions and empower them to make informed decisions. Online shopping platforms use AI to make personalized recommendations, nudging users towards certain products based on past browsing behavior. While convenient, this can subtly influence purchasing decisions, making users more susceptible to impulse buys.

The influence of artificial intelligence on our consciousness is a complex and multifaceted phenomenon. On the one hand, AI opens new opportunities for development and self-realization. On the other, it presents new challenges related to ethics, privacy, and social consequences. To maximize the potential of AI and minimize its negative impact, continuous research, the development of effective regulatory mechanisms, and critical thinking are essential.

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**Ivantsok O. S.**  
**BUILDING MOMENTUM TO REALIGN INCENTIVES TO SUPPORT  
OPEN SCIENCE**

*Language Advisor – Senior Lecturer Tykhonova M.Ye.*

Unstable world situation and war in Ukraine highlight the urgent need to strengthen global scientific collaboration. Open Science (OS) aims to make science accessible, transparent, and effective by providing barrier-free access to scientific publications, data, and infrastructures, along with open software, Open Educational Resources, and open technologies.

Over the past decade, momentum towards the widespread adoption of OS practices has been primarily driven by declarations. These serve an important role, but for OS to truly take root, researchers also must be fully incentivized and rewarded for its practice. This requires research funders and academic leaders to take the lead in collaborating with researchers in designing, and implementing new incentive structures, and to actively work to socialize these throughout the research ecosystem. The US National Academies of Science, Engineering, and Medicine (NASEM) Roundtable on Aligning Research Incentives for OS is one such effort. This paper examines the strategy behind convening the Roundtable, its current participant makeup, focus, and outputs. It also explores how this approach might be expanded and adapted throughout the global OS community.

Researchers have not yet universally embraced OS. The most universally shared concern is that they simply will not be rewarded for engaging in OS practices in the processes that matter the most to the same degree that they are rewarded for engaging in conventional closed practices.

For meaningful change to occur, it is critical for research funders and universities to work together. When funders enact open research policies, they routinely encounter a common challenge with researchers: funder open access policies are often in direct conflict with their institutions' promotion and tenure requirements. For example, a funder may require making articles open access (OA), but the researchers' institutions tenure policy only rewards publishing in non-OA

journals with specific impact factors. This puts researchers in a position that is very difficult for them to navigate.

As funders became aware of this issue, they began to reach out directly to university leaders to work together to solve this problem. To achieve the kind of impact necessary to catalyze systemic change, it is critical for these conversations to be coordinated at a highly visible, national level.

In February of 2019, in collaboration with the Open Research Funders Group, the National Academies launched the Roundtable on aligning research incentives for OS. This multi-year project convenes critical stakeholders to fundamentally improve the correlation between open practices, credit/reward systems, and research missions and values. The initial focus was defining the practices that constitute OS and the general principles and values supporting OS.

The Roundtable participants' approach to addressing its charge is intentionally action-oriented. While they meet in-person (or during the pandemic virtually) just twice per year, the participants made the decision during their first convening to self-organize into working groups in order to facilitate work to be done consistently throughout the year. The initial working groups are organized around:

1. Identifying stakeholder gaps to accelerate adoption and harmonization;
2. Reimagining outputs to facilitate dissemination, reproducibility and replication, discussion, and curation;
3. Examining good practices for OS;
4. Supporting OS activities through disseminating success stories;
5. Sending signals to researchers that OS is valued; and
6. Catalyzing provost/departments chair conversations to increase open sharing of research outputs.

The next phase of the Roundtable will focus on amplifying its impact. This will require diversifying and expanding both internal participants and external collaborators.

In order for the Roundtable's activities to grow to the scale they need to truly be impactful, they have to be adopted and sustained by established entities in the research, funder and higher education communities. The Roundtable participants have made a start at building potential channels to realize this goal, through establishing collaborative programs with important stakeholders, including scholarly societies, federal agencies and executive brand working groups, and national university associations.

Perhaps most critically, the Roundtable must work to extend its efforts to connect and collaborate with international efforts and build network effects.

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### **Kolenchenko Ya. S. POTENTIAL AND DANGERS OF ARTIFICIAL INTELLIGENCE FOR SOCIETY**

*Scientific Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.  
Language Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*

Artificial intelligence is one of the most powerful technologies in the modern world, constantly evolving and increasingly influencing people's lives. It encompasses many areas, such as machine learning, natural language processing, computer vision, and robotics. The use of AI is spreading to various industries: from healthcare to the financial sector, from transport to art. The development of

artificial intelligence creates enormous prospects for humanity, particularly in improving the quality of life, increasing productivity, and accelerating scientific and technological progress. However, it also poses serious threats such as job displacement, privacy concerns, and potential misuse of AI-powered systems, which could have significant consequences for society, the economy, and the individual.

Artificial intelligence offers enormous opportunities to improve the quality of life, which is one of its main advantages. For example, AI can play a crucial role in diagnosing diseases in the medical field. Thanks to powerful data processing algorithms, AI can analyze large amounts of medical information much faster and more accurately than a doctor can.

AI's role in the transport sector is particularly noteworthy. The integration of autonomous vehicles, such as self-driving cars, is a prime example. These systems can react to traffic situations much quicker than humans, thereby reducing the number of road accidents. Research shows that most accidents are due to human factors like fatigue, inattention, or non-compliance with traffic rules. AI can significantly mitigate these risks, as its algorithms can continuously analyze the current traffic situation and make optimal decisions.

Artificial intelligence also has a vast potential for developing science and technology. One key aspect is AI's ability to process and analyze vast amounts of data, which is essential in scientific research. In particular, AI algorithms are used in genetics to analyze genomic data to identify mutations that can cause hereditary diseases. This opens up the possibility of creating new treatments and correcting genetic defects. In addition, in physics, AI helps in modelling complex physical processes, which contributes to discovering new materials or studying the properties of already known ones.

Beyond science, artificial intelligence can become an essential tool in education. Adaptive learning systems using AI can automatically adjust educational programs to the needs of each student. This means the learning process becomes

more individualized, and students can study material at their own pace. This personalization of education contributes to better learning and improved academic results.

However, along with the positive aspects of using such technologies in the educational process, there are also potential risks. One of the most significant drawbacks is that students can become too dependent on AI to solve learning tasks, leading to decreased critical thinking and independence. They may turn to AI for ready-made answers instead of solving math problems or writing essays independently. This can hinder the development of analytical skills and creativity essential to successful learning.

In addition, using AI can lead to problems with academic integrity, as it is essential to note that although AI can generate texts, they are not always original or in line with academic standards. This can be a severe problem in educational institutions where academic integrity is crucial.

So, along with the benefits of artificial intelligence, there are serious dangers that cannot be ignored. One of the most severe problems is the responsibility for the actions taken by artificial intelligence. If an autonomous car causes an accident or a medical algorithm makes an incorrect diagnosis, the question arises: who is responsible for this? The programmer who created the algorithm, the owner of the technology, or the manufacturing company? The absence of clear answers to these questions creates legal and ethical issues that may negatively affect the trust in AI (Фратавчан, Фратавчан, Лукашів, Літвінчук, 2023).

It should also be added that despite the fact that artificial intelligence plays a huge role in the modern world, radically changing various aspects of life, from everyday activities to global technological processes (automation, which allows automating complex tasks in many industries, such as manufacturing, transport and the financial sector; medicine, where artificial intelligence helps in diagnosing diseases, analysing medical images and even developing medicines; personalisation, where AI systems are used to create personalised recommendations, so such as



offering products on online platforms or creating content relevant to the user's interests; transport, where self-driving cars and drones are just some of the innovations made possible by AI; cybersecurity, where AI is used to detect threats and cyberattacks in real-time, helping to protect large networks and information systems; education, namely to individualise the learning process by providing students with materials and tasks that match their abilities and needs), but it is also accompanied by ethical challenges, and this should be kept in mind.

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**Kovtun D. O.**

### **OPPORTUNITIES AND THREATS OF ARTIFICIAL INTELLIGENCE**

*Scientific Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*  
*Language Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*

Artificial intelligence is a hotly debated topic, with many discussions about its potential benefits and dangers for society. Artificial intelligence has significantly impacted many areas of our lives, from medicine and transport to education and entertainment. However, as its capabilities expand, it is essential to understand its benefits and threats.

In terms of benefits, AI can automate routine tasks, allowing people to focus on more complex and creative work. It increases productivity in industries such as manufacturing, healthcare, and customer service by optimizing processes.

Artificial intelligence can diagnose diseases at early stages with great accuracy. Algorithms analyze medical images and histories, allowing doctors to make more informed decisions.

Artificial intelligence allows scientists to process vast amounts of data, which speeds up research and discovery in various fields. It also accelerates scientific research by analyzing vast amounts of data, finding patterns, and generating ideas faster than humans, for example, in climate change modelling, biology, and space exploration.

Artificial intelligence systems can process and analyze massive data sets to support better business, finance, and public policy decision-making.

Artificial intelligence is used in various safety-critical systems, such as autonomous vehicles, fraud detection, and cybersecurity, reducing human error and improving the security of complex operations.

AI algorithms can analyze large amounts of data and offer users personalized products or services, improving service quality.

However, we should not forget the dangers of AI, which include mass automation, which could lead to job losses in many industries, especially for unskilled workers.

Artificial intelligence collects and analyses enormous amounts of data, which risks users' privacy. Possible information leaks or unauthorized use of personal data can harm society.

Modern AI systems have not yet reached the level of self-awareness, but the rapid development of this industry can lead to unpredictable consequences. If systems become too complex to control, they may act against people's interests.

Countries and companies with access to advanced technologies may gain a significant advantage, leading to even greater global inequality.

Consequently, AI is widely used in everyday life, whether virtual assistants such as Siri, Google Assistant, or Alexa help with tasks and answer questions or services such as Netflix or Spotify that use AI to analyze user preferences and offer relevant content.

Artificial intelligence helps manage personal finances, automates investments, and detects fraud in online transactions. It powers self-driving cars,

improving the safety and efficiency of transportation. Of course, this is not the whole list of applications that make everyday life more convenient, efficient, and secure (Лубко, Шаров, 2019).

However, it should be remembered that artificial intelligence offers society a vast potential for development, but it also carries serious risks. To avoid negative consequences, it is necessary to create ethical norms for using artificial intelligence, develop legislation, and invest in education so that society can adapt to new realities.

In summary, while artificial intelligence offers tremendous potential to improve many aspects of life, its development and deployment should be handled carefully to mitigate potential risks. Responsible AI development requires solid ethical principles, regulation, and public awareness.

It should also be added that artificial intelligence (AI) plays an increasingly important role in education, providing new opportunities to improve the quality of learning and adapt to the needs of each student.

It is important to note that integrating AI into education contributes not only to improving academic achievements but also to developing new forms of learning, making it more flexible and accessible.

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**Kovtun Yu. S.**  
**ARTIFICIAL INTELLIGENCE FOR CREATING 3D VIDEO GAME**  
**MODELS**

*Language Advisor – CandSc (Education), Assoc. Prof. Borzenko O. P.*

The article examines the role of artificial intelligence (AI) in the process of creating 3D video games models. In particular, modern methods, algorithms and tools used to automate the modeling process and reduce time and resource costs are analyzed. Examples of successful use of AI in popular video games are given and the challenges faced by developers when implementing AI in the field of 3D modeling are explored.

Modern requirements for the visual quality of video games are increasing every year, but the process of creating 3D content is expensive and time-consuming. Using AI can help simplify the process of creating high-quality models and reduce the time required for their development. However, AI tools have limitations and need to be improved to ensure the required quality and meet the creative requirements of the gaming industry.

Important aspects of 3D modeling and implementation of artificial intelligence technologies were considered by both Ukrainian (N. Morse, V. Umanets, L. Shevchenko, V. Bykov, D. Klymenko, L. Polyakova, M. Shyshkina, I. Gromova, O. Glazunova and others) and foreign scientists (B. Sejati, G. Siekmann, D. Corbett, I. Kaniawati, M. Melton, P. Korbel, S. Baumer, C. Dumaresq, H. Jang, H. Firman, M. Song, A. Carnevale). Their research has significantly contributed to the development of AI science and its application in education and the 3D modeling industry, confirming the relevance and importance of these technologies.

The purpose of this article is to explore the AI capabilities in the process of creating 3D video games models, identify the advantages and disadvantages of its use, and discuss the prospects for the development and improvement of AI tools in the field of game graphics.

The use of artificial intelligence in creating 3D video games models is a hot research topic due to its ability to speed up development processes, reduce costs, and improve the quality of the final product. In the video game industry, this means the ability for faster and more cost-effectively creating high-quality game objects, such as characters, landscapes, and animations, that meet the increasing requirements of players and developers (Глибовець & Олецкий, 2002, pp. 5-9).

Among the AI technologies used for 3D modeling, the most effective ones have been generative adversarial networks (GAN), convolutional neural networks (CNN), as well as computer vision and image processing methods. For example, GANs are actively used to create realistic textures and surfaces, and CNNs help model complex shapes and details of objects. These methods allow achieving high quality visualization while saving resources required for content creation (Субботін, 2008, pp. 71-74). In addition, algorithms for simulating physical phenomena are used, allowing for the reproduction of realistic interaction of objects with the environment. Physics simulations help create realistic animations of characters and environments, adding depth and realism to the gameplay (Морзе, 2006, pp. 237-238).

Some modern video games use AI to create characters and the game world in real time. For example, neural network technology is used to automatically generate characters with unique facial features, behavior, and emotions, making the game world more alive and richer (Руденко & Бодянский, 2006, pp. 26-27). In games like *Cyberpunk 2077* and *Red Dead Redemption 2*, AI helps create crowd scenes with a large number of unique NPCs (non-player characters), each with their own behavior patterns.

Another example is the use of AI for procedural world generation, as in the game *No Man's Sky*, where each planet has unique landscape, vegetation, and climatic conditions. This is achieved through AI algorithms that allow for the creation of multiple variations, providing players with new experiences during each playthrough.

The implementation of AI in the process of creating 3D models faces a number of challenges that limit its wide application. One of the main challenges is the need for a large volume of data to train algorithms, which requires significant computing resources. The quality of the created AI models sometimes doesn't meet the manual modeling standards, so additional optimization is required (Субботін, 2008, pp. 9-10).

Another problem is creative limitations. Although AI can automate routine tasks, it cannot yet completely replace an artist or designer, since the creative process is difficult to algorithmize. In addition, some AI algorithms sometimes create visual artifacts or inaccuracies that require expert correction (Субботін, 2008, pp. 9-10).

The prospects for AI development in 3D modeling include improving algorithms and reducing computational costs. One direction is to create more efficient models that use less data for training, making the technology more accessible to smaller studios. Another important direction is the AI integration with virtual reality (VR) and augmented reality (AR) technologies, which will allow creating more exciting game environments. For example, using AI, developers can create flexible 3D models that adapt to the player's actions in real time, making the gaming experience more personalized and exciting (Нікольський, 2013, pp. 164-168).

Artificial intelligence is already significantly influencing the processes of creating 3D models for video games, reducing the time and effort required for their development. However, there are technical limitations and challenges that need to be addressed in order for AI to become an integral part of the creative process. Further research in this direction could lead to revolutionary changes in the creation of virtual environments and video game characters.

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**Krainiuk M. Yu.**

### **INTEGRATION OF AI AND IOT INTO THE MANAGEMENT OF MACHINE AND TRACTOR UNITS**

*Scientific Advisor – Cand. Tech. Sc., Assoc. Prof. Shcherbak O.V.*

*Language Advisor – Cand. Ped. Sc., Assoc. Prof. Skrypnyk N. S.*

Integrating artificial intelligence (AI) and the Internet of Things (IoT) into machine and tractor units for urban and construction work is changing how we manage and operate machinery. Traditionally, operators have operated machines manually, using their own experience and physical strength to complete tasks. However, introducing AI allows for the automation of a significant part of these processes.

AI analyses large amounts of data in real-time, optimising machine performance, ensuring task accuracy, and reducing human error. AI systems can make decisions independently, such as route processing, trajectory correction, engine load adjustment, and other key parameters. At the same time, IoT allows machines, sensors, and analytical systems to be connected to a single network, creating an integrated ecosystem for continuous monitoring and control.

Let's analyse the main opportunities offered by the integration of AI and IoT in the management of modern machine and tractor units. The diagram (Fig. 1) shows aspects such as automatic control, which reduces the need for constant operator presence, breakdown prediction through sensor data analysis, and real-time monitoring of system status to maintain high productivity and respond quickly to malfunctions. These technologies increase machine efficiency and minimise the risk of downtime.

The introduction of autonomous systems based on AI and IoT is fundamentally changing the approach to managing construction and urban machines, allowing for the automation of complex processes and increased accuracy of tasks. Major global companies are actively integrating these technologies into their machinery, ensuring more efficient and safer operations.

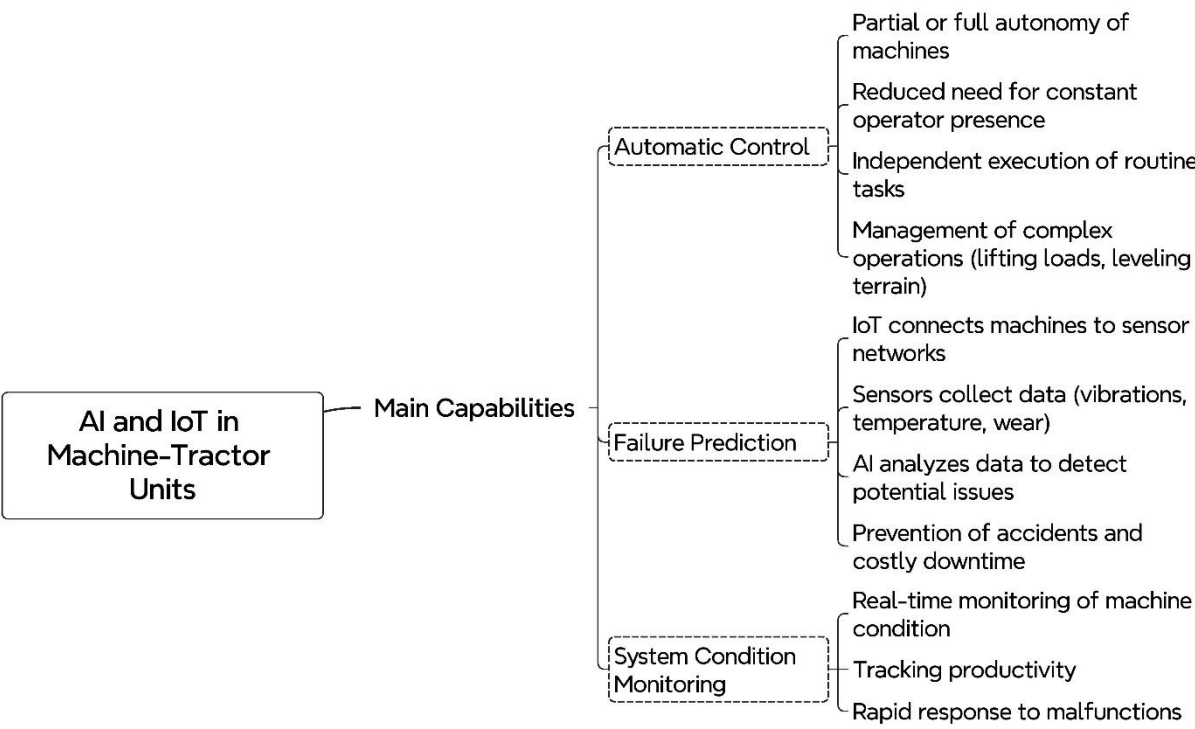


Figure 1. Integration of AI and IoT into the management of machine and tractor units: main opportunities

Autonomous AI and IoT systems are already being actively implemented in the construction industry. Modern excavators and bulldozers are equipped with



systems that automatically adjust the bucket lifting height, handle terrain with centimetre accuracy, and can perform complex manoeuvres without operator intervention. This reduces errors and speeds up the completion of tasks.

For example, Caterpillar has introduced Cat® Command [1], which allows excavators and bulldozers to work remotely or autonomously. This system automatically adjusts the bucket lift height and ensures terrain accuracy of up to several centimetres. Komatsu has developed the Smart Construction system, which uses AI and IoT to automate construction processes, including independent earthworks using sensors to precisely level the ground [2].

Volvo Construction Equipment is actively integrating autonomous systems into its machines, including excavators that can perform various operations, including loading and unloading materials, on their own.

For example, their LX03 autonomous wheeled loader concept is self-learning and capable of making decisions and performing tasks without human intervention. This prototype uses artificial intelligence to collaborate with humans to perform hazardous or routine tasks on construction sites, reducing risks to workers and increasing the efficiency of operations. The LX03 is also a zero-emission electric machine, which underlines Volvo's commitment to sustainability [3].

Another example is the TA15 autonomous dump truck, which is powered by electric traction and designed to perform repetitive tasks such as transporting goods on construction sites. The TA15 can operate around the clock without human intervention, which significantly increases productivity and reduces the impact of human error on safety [4].

These examples demonstrate how major engineering companies are using AI and IoT to create intelligent, autonomous solutions that increase efficiency and safety on construction sites.

Other examples of AI and the Internet of Things (IoT) being used in autonomous road construction machines include Volvo Construction Equipment, which is introducing autonomous road rollers and other machines. The Volvo

CX01, for example, is an autonomous asphalt roller powered by electricity. This machine uses sensors and artificial intelligence algorithms to accurately measure and correct the compaction of the pavement, which reduces the need for human intervention and improves the quality and safety of work.

In cities, autonomous snow ploughs and road rollers significantly increase the efficiency of infrastructure maintenance. For example, in Ottawa and Kingston (Canada), IoT systems are being implemented to track the location of snowplows in real time [5]. This allows for more efficient route planning, taking into account weather conditions and pavement conditions, which helps to avoid skipping certain sections of streets and reduces cleaning time. Data on equipment performance is collected and analysed to optimise future performance, and is also made available to residents through apps to better plan their trips during snowfalls.

Thanks to AI integration, such machines can optimise routes for street cleaning or road repair, taking into account road surface conditions, weather conditions and other variables. IoT systems allow city services to remotely monitor their location and performance. Other examples include the introduction of AI algorithms to predict road surface conditions and automatically make decisions on the use of salt or other materials to combat snow and ice, which significantly increases the efficiency of winter street maintenance. These systems help reduce the workload on staff and improve road safety, especially during heavy snowfall.

Integration of AI into machine and tractor units allows automating the process of route optimisation, which leads to a significant increase in efficiency (Fig. 2). For example, by analysing data from sensors such as GPS and other monitoring systems, machinery can independently determine the most efficient routes for performing tasks, taking into account current road conditions, traffic jams, and even weather conditions. This helps to reduce downtime and fuel costs, as optimised routes reduce the overall distance travelled. Studies show that this use of AI can reduce maintenance costs and increase productivity by 20-30% compared to traditional methods.

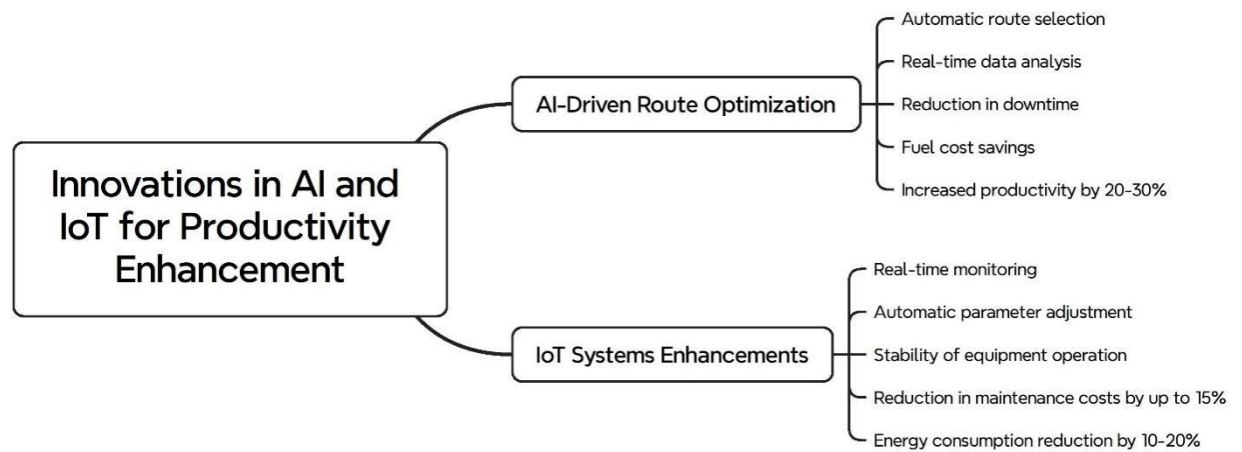


Figure 2. Optimising productivity through AI and IoT in machine and tractor units

IoT systems provide continuous monitoring and control of machinery in real time. They allow machines to automatically adjust operating parameters in response to changes in load, temperature, humidity and other variables. This not only ensures the stability of the machinery, but also helps to reduce the risk of breakdowns, extending the life of the equipment. It is estimated that such systems can reduce costs.

Thus, the integration of AI and IoT into the management of machine and tractor units opens up new opportunities for increasing productivity and safety, reducing the human factor and ensuring more efficient resource management.

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**Kuznetsov A.R.**  
**UNREAL ENGINE 5: ANALYSIS OF OPPORTUNITIES AND  
DEVELOPMENT PROSPECTS**

*Language Advisor- Lecturer Lukianenko N.M.*

Introduction. Unreal Engine has long been a dominant force in the game development industry, celebrated for its versatility and capacity to generate stunning visuals. The advent of Unreal Engine 5 has significantly raised the bar. This next-generation engine boasts groundbreaking features poised to revolutionize interactive entertainment and extend its influence beyond gaming. This article analyzes the opportunities and development prospects presented by Unreal Engine 5, examining its technological advancements, potential impact on various game genres, and applications in non-gaming sectors.

Technological Advancements. Unreal Engine 5 introduces a suite of cutting-edge technologies that empower developers to craft more immersive and realistic experiences. Nanite, a virtualized geometry system, facilitates the rendering of incredibly detailed models comprising millions of polygons, eliminating the need for manual optimization. This results in environments with unprecedented visual fidelity, as demonstrated in breathtaking demos showcasing intricate architectural

details and lifelike characters. Lumen, a fully dynamic global illumination system, generates realistic lighting and reflections in real-time, further amplifying the visual impact. World Partition streamlines the creation of massive open worlds by dividing them into manageable segments, enabling seamless transitions and improved performance. Additionally, the enhanced animation and physics tools afford developers greater control and realism in character movement and interactions.

**Impact on Game Genres.** The advancements in Unreal Engine 5 have profound implications for various game genres. Open-world games are poised to benefit significantly from World Partition and the engine's capacity to handle vast, detailed environments. Players will explore sprawling landscapes with seamless transitions and a level of detail previously unattainable. A prime example is the highly anticipated S.T.A.L.K.E.R. 2, which utilizes Unreal Engine 5 to create a hauntingly beautiful and immersive rendition of the Chernobyl Exclusion Zone. The game's trailers have showcased stunning visuals and atmospheric environments, generating immense excitement among fans and demonstrating the engine's potential for crafting expansive and believable open worlds.

Action-adventure games can leverage the improved animation and physics systems to design more fluid and responsive character movements, culminating in more engaging combat and traversal mechanics. *Hellblade 2: Senua's Saga* will leverage these advancements to deliver visceral and impactful combat encounters. The enhanced realism in character animations and physics interactions can significantly elevate the sense of immersion and player agency in action-heavy experiences.

Simulation and strategy games can utilize the engine's capabilities to construct intricate and interactive worlds populated with dynamic elements and complex systems. Envision city-building simulations with unprecedented levels of detail and realism, or strategy games with vast armies clashing in epic battles

rendered with stunning fidelity. The potential for creating believable and engaging simulated worlds is immense.

Narrative-driven games can further immerse players in their stories through photorealistic graphics and believable environments, thereby enhancing emotional engagement. The upcoming title, *Black Myth: Wukong*, has captivated audiences with its stunning visuals and cinematic presentation, powered by Unreal Engine 5. The engine's ability to create lifelike characters and environments can significantly enhance the emotional impact of storytelling in games.

Potential Beyond Gaming. While Unreal Engine 5 is undeniably a game-changer for the gaming industry, its potential extends far beyond. The film and television industry is readily adopting Unreal Engine for virtual production, previsualization, and special effects. The capacity to generate photorealistic environments and characters in real-time unlocks new possibilities for filmmakers, affording them greater creative control and enabling cost-effective production. Architects and designers can leverage Unreal Engine 5 to create stunning visualizations and interactive walkthroughs of their projects, affording clients immersive experiences. In the automotive and manufacturing sectors, the engine can be employed for design visualization and simulation, streamlining workflows and improving product development. Furthermore, Unreal Engine 5 possesses immense potential for education and training, enabling the creation of interactive simulations and virtual learning environments.

Challenges and Future Outlook. Despite its immense potential, Unreal Engine 5 presents certain challenges. The high-fidelity graphics and advanced features necessitate powerful hardware, which may limit accessibility for some developers and users. Early adopters of the engine have encountered difficulties in optimizing their games for a wide range of hardware configurations. For instance, some games built on Unreal Engine 5 have exhibited performance issues, such as low frame rates and stuttering, even on high-end PCs. This highlights the need for careful optimization strategies and efficient resource management to ensure smooth

gameplay experiences across different hardware specifications. Additionally, mastering the new tools and workflows demands a learning curve. Competition from other game engines persists, with Unity and other contenders vying for market share. Nevertheless, the future of Unreal Engine 5 appears promising. Epic Games' commitment to continuous improvement and community support suggests that the engine will continue to evolve and maintain its position at the forefront of interactive technology. As developers gain more experience with the engine and optimization techniques improve, it is likely that these challenges will be mitigated, unlocking the full potential of Unreal Engine 5 for creating groundbreaking interactive experiences.

**Conclusion.** Unreal Engine 5 represents a significant advancement in interactive technology, offering a wealth of opportunities and development prospects. Its groundbreaking features empower developers to create stunning visuals, expansive worlds, and immersive experiences. The engine's impact transcends the realm of gaming, with applications in film, architecture, design, and education. While challenges persist, the future of Unreal Engine 5 is promising, and it is poised to shape the future of interactive entertainment and digital experiences for years to come.

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**Kyrylov D. I.**  
**ARTIFICIAL INTELLIGENCE**  
*Language Advisor – CandSc (Education), Assoc. Prof. Borzenko O. P.*

Artificial intelligence is an interdisciplinary field that combines Machine Learning, Big Data, Cloud Computing, and Information Theory. The main Machine Learning advantage is that it is based on previous experience, so machines are self-learning and can accurately predict the future. It is a kind of decision-making approach applied in various fields like social media, healthcare, finance, etc. In Big Data and Cloud Computing, the volume of data is sustainable and growing which is processed with low energy consumption using machine learning. It is possible to support the next generation of smart grid by providing a platform that integrates, in addition to the communication infrastructure, the support of artificial intelligence and the Internet of Things, providing a multi-user system thanks to the future Massive Internet of Things (MIoT), one of the pillars of the 5G/6G network factory (IEEE Xplore, 2023).

Generative modelling is an artificial intelligence (AI) technique that generates synthetic artefacts by analyzing training examples; studying their patterns and distribution, as well as creating realistic facsimiles. Generative artificial intelligence (GAI) uses generative modelling and advances in deep learning (DL) to create diverse content at scale using existing media such as text, graphics, audio, and video (IEEE Xplore, 2023).

Generative adversarial networks (GANs) are the most common GAI method used today. A GAN uses a pair of neural networks. One, known as a generator, synthesizes content (such as an image of a human face). The second, known as the discriminator, evaluates the authenticity of the generator's content (i.e. the face is natural or fake). Networks repeat this generation/discrimination cycle until the generator produces content that the discriminator cannot distinguish between real and synthetic (IEEE Xplore, 2024).



Generative pre-trained transformer (GPT) models generate text in multiple languages and can create human-sounding words, sentences, and paragraphs for almost any topic and writing style, from persuasive articles to customer service chatbot conversations or video game characters. They have evolved over several generations, each with an increased set of parameters trained on a more extensive online text corpus than the previous ones. One recent example is OpenAI's GPT-3, which stunned the artificial intelligence world by writing a convincing paper without human assistance about scientists discovering a herd of unicorns in the Andes (IEEE Xplore, 2023).

Geometric DL (GDL) attempts to understand, interpret, and describe AI models in terms of geometric principles. These principles have already been extensively studied in fields like grids; transformation in homogeneous spaces; graphs and vector bundles.

GPT can be easily applied to the generation of natural language (NL) text. GPT-3 has been successfully scaled to 175 billion learnable parameters and trained on global text sample corpora. In addition to showing high performance in a variety of NL processing (NLP) tasks such as translation and question answering, it is also a competent text generator producing text content that is remarkably human-like.

For example, a GPT-3 program wrote an entire student essay from a simple prompt (“The ‘learning styles’ construct is problematic because...”). The story flowed as if it was written by a human – the plagiarism software didn’t copy, and a Google search showed that every sentence was original. The authors highlighted several potential applications of GAI tools in education, such as facilitating creative writing (e.g., students and artificial intelligence periodically write paragraphs to explore alternatives and overcome writer's block) or developing critical analysis of academic writing (e.g., artificial intelligence generates texts) on a topic, and students critique and revise them.

Another example is the Language Model for Dialogue Applications (LaMDA). This generative text-based conversational agent simulates human

conversations, but unlike GPT models trained on text corpora, it is trained on dialogue corpora. Objective-Reinforced GAN (ORGAN) is another example that creates time series artifacts in sequential media such as music.

AlphaFold is a neural network that creates highly accurate 3D protein structures by modeling and predicting protein structures as a graph inference problem in 3D space where nearby residues define the edges of the graph. The pair representation is encoded as a directed edge in a graph (that is, a connection between residues). NVIDIA Canvas GauGAN application transforms a text phrase like "ocean waves hitting rocks on the beach" into virtual landscape images in real time. By adding adjectives like "sunset on a rocky beach" or replacing "sunset" with "afternoon" or "rainy day," the model instantly modifies the picture. Similarly, DALL•E is a compiled version of GPT-3 that creates images from text descriptions of concepts expressed in NL, using text/image pairs as input. The latest GDM-based approaches for generating text in images, DALL•E and Imagen, are capable of producing a variety of high-quality artistic and realistic images, respectively. 3D-GAN creates 3D shapes that can be manipulated in 3D spaces (geometric transformation) and then scaled down to 2D image representations (IEEE Xplore, 2023).

Using semantic label maps as input, conditional GANs (CGANs) can create images of high-quality urban scenes containing objects. Changing the labels modifies the scenes related to individual objects, such as replacing trees with buildings or changing colors or textures. TediGAN (Text-Guided Diverse Face Image Generation and Manipulation) creates human portrait drawings from facial photos with random changes to facial attributes. SinGAN is a single-image generative model that synthesizes realistic textures of arbitrary size and aspect ratio with significant variability.

Decomposing Motion and Content of GAN (MoCoGAN) performs video synthesis in two separate ways. Content can have different movements. Conversely, it can apply the same action to different content. Enhanced Super-Resolution GAN

(ESRGAN) improves the quality of media files using super-resolution, a group of ML methods that upscale low-resolution images or videos to higher resolutions. Accuracy refers to the intended performance of synthesized artifacts, while complexity refers to their richness of media content and structure.

Artificial intelligence (AI) has the potential to fundamentally change the business landscape, offering companies numerous opportunities to automate processes, personalize customer interactions, and more. The rapid development of deep learning, artificial intelligence (AI), and machine learning (ML) will provide better results for future applications (IEEE Xplore, 2024).

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**Levenets E. V.**

### **ARTIFICIAL INTELLIGENCE: BENEFITS AND THREATS**

*Scientific Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*  
*Language Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*

Artificial intelligence (AI) is a rapidly developing technology that attempts to replicate the human mind's ability with a machine, allowing it to perform simple and complex tasks. AI has advantages and disadvantages, but people must focus on using the positive aspects of this technology to create a better world. Today, AI is already being actively used in healthcare, the financial sector, and transport. Its development ranges from highly specialized intelligence that performs specific

tasks to the hypothetical concept of strong AI or AGI (artificial general intelligence), capable of performing any human-level intellectual work. The future development of this technology holds great promise but also requires careful analysis and constant monitoring of its social and ethical implications.

Artificial intelligence has developed significantly in recent years and has become an integral part of business and everyday life. People use AI daily to simplify their lives by interacting with virtual assistants or other applications based on this technology. Businesses also use AI to optimize production processes, analyze profit and loss, and predict when maintenance is needed. An AI program is capable of learning and thinking. However, along with its undoubted benefits, this technology raises serious questions about its threats. It is important to note both the positive aspects of AI and the potential dangers to understand its impact on the future of humanity.

The first significant benefit of introducing artificial intelligence is that it reduces human error and risks to humans. AI's decisions at each step are determined by pre-collected information and a specific set of algorithms. With proper programming, these errors can be reduced to zero. Using artificial intelligence can help prevent injury or harm to people.

AI is also revolutionizing healthcare by improving diagnostics, developing individualized treatment plans, and discovering new medicines.

AI algorithms can deeply analyze user behavior, preferences, and interactions to provide a personalized experience. AI can use this data to tailor content recommendations, targeted advertising, and customized user interfaces to provide a more engaging and satisfying user experience. In education, AI creates individualized curricula that match a student's pace and learning style, helping them to learn more effectively.

And, of course, one of the critical advantages of AI is its round-the-clock availability. AI systems, such as chatbots or virtual assistants, can assist users anytime without interruption.

On the downside, of course, AI could lead to large-scale job losses, especially in industries such as manufacturing, logistics, and customer service. This can create economic inequality and social unrest.

It is known that such machines sometimes degrade. If an AI model is trained on outdated data, its predictions and decisions may become irrelevant. The model and training data used to create the AI will eventually become old and obsolete, which means that the trained AI will also pass unless it is retrained or programmed to learn and improve independently.

Over-reliance on AI for critical decision-making can lead to losing human skills, judgment, and creativity. If artificial intelligence systems fail or malfunction, this can have catastrophic consequences. Unlike humans, artificial intelligence lacks the innate ability to perceive everyday knowledge and social norms, which may lead to logically correct decisions but is practically or ethically flawed.

Thus, artificial intelligence has great potential to improve the quality of life, optimize processes, and solve complex problems. However, developing and integrating this technology requires full consideration of its ethical aspects, risks, and societal research. It is essential to strike a balance between harnessing the benefits of AI and managing its drawbacks to ensure a secure and just future.

AI also contributes to inclusivity by developing technologies that help students with disabilities gain equal access to education. For example, voice recognition software or systems can be used to teach people with special needs.

AI can automatically adapt learning materials for visual, hearing, or mobility impairments students. For example, speech synthesizers help convert text to voice, which is helpful for students with visual impairments; speech recognition systems convert spoken language to text, making it easier for people with hearing impairments to learn; and motion control applications can help students with physical disabilities interact with a computer or tablet (Доценко, Собченко, Боярська-Хоменко, 2024).

Artificial intelligence makes education more adaptable and accessible to all, opening up new opportunities for students with special needs and allowing them to integrate more effectively into the learning process.

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## **Melnyk V. O. INFORMATION TECHNOLOGIES FOR OPTIMIZATION OF WAREHOUSE OPERATIONS**

*Language Advisor – Senior Lecturer Lysenkova T.M*

Modern warehouses are complex systems where each component performs a specific role. In order to ensure smooth and efficient operation of all processes, information technologies are increasingly being implemented. The use of information technologies allows optimizing the processes of storage, processing and transportation of goods, ensuring high accuracy and efficiency of accounting, improving inventory control and minimizing costs. The urgency of using IT in warehouse management is due not only to the insufficiency of increasing labor productivity, but also to the need of responding quickly to changing market conditions. This article will explore how information technology is transforming modern logistics and the benefits it offers to businesses.

Information technologies play a key role in optimizing warehouse operations. This provides increased efficiency, reduced costs and improved customer service.

Implementation of IT in the warehouse is an investment in the future of your business.

Consider a warehouse management system such as WMS.

Warehouse Management System (WMS) is a great tool or application that helps the Logistics business to manage the inventory effectively and efficiently.[1]

The main purpose of WMS is to ensure effective planning, control and execution of warehouse operations, including receiving, storing, picking, shipping and accounting of goods. It also solves such issues as optimizing the route of product movement, reducing the time of completing tasks, preventing shortages and excess stocks.

Implementing a warehouse management system (WMS) offers several benefits. It significantly increases productivity by automating repetitive tasks, freeing employees from more complex and strategic responsibilities. In addition, WMS improves customer satisfaction by speeding up order fulfillment and reducing errors. By optimizing the allocation of resources and minimizing waste, the software contributes to cost savings. And the real-time display of all actions in the warehouse provides detailed control and enables prompt response to changes.

Choosing such a system like WMS is a big decision. The following factors should be taken into account when choosing a system:

- Cloud solutions are suitable for small warehouses, and more powerful local systems are better for large ones.
- The system should be easily integrated with other ones used in the enterprise.
- The cost of WMS depends on the functionality and scale of the system.

In short, WMS is a game-changer for warehouses, increasing efficiency and competitiveness. It radically changes the approach to warehouse management, transforming it from a manual process to an intelligent system.

The RFID (Radio Frequency Identification) technologies arose after 2003. They improve the effectiveness of many processes. Thanks to automation, it is possible to save a lot of time. [2]

This system is another key to success in today's competitive environment where speed, accuracy and flexibility are critical factors. RFID technology works with a small device known as an RFID tag. This is a non-contact technology for object identification using radio frequency waves. In the context of warehouse activities, RFID tags are attached to goods, pallets, containers and allow to automatically read information about them without the need for direct visual contact.

Advantages of RFID include: the ability to read multiple tags simultaneously;  
longer reading range (from several centimeters to several meters);  
the durability of tags in various environmental conditions and the possibility of recording data on certain tags;

it allows you to automate many routine operations, such as inventory, product tracking, access control;

it also allows tracking the movement of objects in real time, which provides a high level of control over processes;

it provides automated quality control; monitoring of temperature regime; humidity, and other parameters.

Therefore, RFID technology has a great potential for automation and optimization of various processes. Its widespread implementation makes it possible to significantly increase the productivity of enterprises and improve the quality of people's lives.

In recent years, the adoption of automation technologies, particularly artificial intelligence (AI), has transformed traditional warehouse operations, offering new avenues to enhance efficiency and accuracy. [3]

Analyzing data on manufactured products (size, weight, frequency of circulation, storage conditions, shelf life and demand), it is possible to determine



the optimal location for each product, minimizing search and movement time. The technology can predict future demand and automatically redistribute goods for more efficient use of space, and can also optimize inventory levels, preventing shortages and overstocks. AI-controlled robots can autonomously move through the warehouse, pick orders and deliver them to packaging. Artificial intelligence algorithms optimize robot routes, reducing order fulfillment time. AI-based computer vision systems can detect errors in the process of receiving and shipping goods, as well as prevent theft. This thinking machine provides warehouse managers with accurate and up-to-date information on inventory status, employee productivity and other key metrics. This allows you to make more informed decisions and improve the operation of the entire warehouse.

This digital intelligence offers the following technologies for use in warehouse space [4]:

- machine learning algorithms that allow AI systems to learn based on data and make independent decisions;

- natural language processing, namely the processing of text queries and commands, which allows for the integration of warehouse systems with other corporate information systems;

- robotics, equipped with sensors and cameras, perform routine warehouse operations and involve employees in solving more complex tasks;

- computer vision systems that allow you to recognize objects, track their movement and control the quality of goods.

The use of artificial intelligence in warehouses is not just a trend, but a necessity for modern enterprises. AI allows you to optimize all processes in the warehouse, increase efficiency and reduce costs. The implementation of AI is an investment in the future that will allow companies to remain competitive in the market.

Therefore, information technologies offer a wide range of tools for optimizing and improving warehouse operations. Investments in automation and

modern information systems provide not only economic benefits, but also increase the overall productivity of enterprises. The choice of specific solutions depends on the specifics of your business, the size of the warehouse and the tasks you set. Successful implementation of such technologies requires a strategic approach, which includes analysis of needs, selection of appropriate solutions and constant monitoring of results. Implementation of modern information technologies in warehouse operations is a complex process accompanied by some challenges that may affect their integration into the existing environment of the enterprise. Therefore, it requires careful planning and preparation. However, the benefits it brings, such as increased efficiency, reduced costs and improved customer service, make it worth it.

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**Miroshnichenko D. V.**

**GRAVITY ROADS: REVOLUTIONIZING URBAN INFRASTRUCTURE  
FOR A SUSTAINABLE FUTURE**

*Language Advisor – Lect. Myrhorod V. O.*

*Scientific Advisor – Lect. Myrhorod V. O.*

The Gravity Roads project introduces a revolutionary vision for urban infrastructure by combining transportation systems, eco-friendly solutions, and modern technologies. This innovative approach targets critical challenges, such as energy inefficiency, environmental degradation, and resource depletion, paving the way for greener, smarter cities.

The principle behind Gravity Roads is straightforward yet transformative: vehicles utilize natural slopes and gravitational forces to reduce energy consumption. As vehicles descend, they rely solely on gravity, drastically lowering energy usage. Electric vehicles (EVs) particularly benefit from regenerative braking systems, which capture energy during deceleration and store it in batteries for future use. This process minimizes waste and maximizes efficiency.

For uphill travel, Gravity Roads incorporate advanced mechanisms such as magnetic lifts and induction systems embedded into the road surface. These systems provide additional energy for smooth, efficient ascents, eliminating the reliance on fossil fuels (Paiva, S., Ahad, M. A., Tripathi, G., Feroz, N., Casalino, G., 2021).

Beyond transportation, Gravity Roads act as power generators. Solar panels integrated into the road surface harvest sunlight, supplying renewable energy to traffic systems, streetlights, and EV charging stations. Additionally, piezoelectric

materials embedded in the road convert pressure from moving vehicles into electricity. This dual-purpose design makes Gravity Roads not only energy-efficient but also energy-producing, directly contributing to urban sustainability (Yang, Z., Li, J., 2022).

Environmental benefits are another key aspect of Gravity Roads. Vegetation planted along roadsides and medians absorbs CO<sub>2</sub>, reduces noise pollution, and enhances air quality. Meanwhile, permeable road surfaces allow rainwater to filter into the ground, replenishing groundwater reserves and mitigating urban flooding risks. These features make Gravity Roads an integral part of urban ecological systems, promoting resilience and sustainability (Singh, A. K., Aljohani, A., Uddin, S. M. J., Chauhan, K., Peltokorpi, A., Seppänen, O., Baghdadi, A., Shakor, P., Awuzie, B. O., Shivendra, B. T., & Lavikka, R., 2023).

A standout feature of Gravity Roads is their integration with smart technology. Embedded sensors monitor real-time data on traffic patterns, road conditions, and weather. This information is processed to optimize traffic flow, reduce congestion, and enhance safety. IoT connectivity enables communication between vehicles and road infrastructure, providing drivers with hazard warnings, alternative routes, and real-time updates. This makes urban transportation safer, more efficient, and aligned with the goals of smart city initiatives (Butler, L., Yigitcanlar, T., Paz, A., 2020).

Gravity Roads also redefine urban planning by offering multifunctional spaces. These roads can serve as energy hubs and ecological corridors, fostering biodiversity and mitigating the urban heat island effect. For instance, vertical gardens or green roofs on elevated roadways can transform them into visually appealing, environmentally beneficial spaces. Such designs contribute to both city aesthetics and environmental health (Alam, T., Gupta, R., Ahamed, N. N., Ullah, A., & Almaghthwi, A., 2024).

Global implementations of similar technologies underscore their potential. Solar roads in the Netherlands demonstrate how road surfaces can generate

renewable energy, while piezoelectric roads in Israel highlight the feasibility of converting vehicle movement into electricity. These projects showcase the transformation of conventional roads into active contributors to sustainability.

For Ukraine, adopting Gravity Roads could modernize infrastructure, reduce energy dependence, and align with international environmental standards. By leveraging these technologies, Ukrainian cities could enhance ecological resilience, boost economic competitiveness, and establish themselves as leaders in innovative urban development (Alam, T., Gupta, R., Ahamed, N. N., Ullah, A., & Almaghthwi, A., 2024).

Gravity Roads represent a visionary step toward integrating engineering, sustainability, and technology into urban infrastructure. By harnessing natural forces, generating renewable energy, and incorporating smart systems, these roads transform traditional pathways into dynamic networks that support environmental and urban needs.

As global cities face increasing sustainability challenges, Gravity Roads offer a forward-thinking solution that enhances both urban efficiency and environmental health. Their implementation could pave the way for smarter, greener cities that prioritize innovation and ecological balance for generations to come.

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**Morkova V. O.**

### **ARTIFICIAL INTELLIGENCE: PROGRESS OR RISK?**

*Scientific Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*  
*Language Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*

The concept of artificial intelligence was formulated in the second half of the 20th century. John McCarthy gave one of the first definitions of artificial intelligence at a conference at Dartmouth College (New Hampshire) in 1956, where he defined artificial intelligence as a way to make a computer think like a human being. Understanding the concept of intelligence as a system's ability to learn leads scientists to another definition of artificial intelligence, which is described as the ability of automated systems to acquire, adapt, modify, and replenish knowledge to find solutions to problems that are difficult to formalize.

The human need to find solutions in the realities of the modern world, such as inaccuracy, ambiguity, uncertainty, vagueness, and unreasonableness of information, has made the intellectualization of computer systems a topical issue.

The need to increase the speed and adequacy of this process stimulates the creation of computing systems that, through interaction with the natural world using robotics, production equipment, instruments, and other hardware, can contribute to its implementation. Computing systems are based exclusively on classical logic, i.e., algorithms for solving known problems, and they face issues when faced with uncertain situations. In contrast, although they lose speed, people can make successful decisions in such situations.

The following opportunities and peculiarities of artificial intelligence application can be distinguished, for example, in the economic sphere:

- artificial intelligence has a more remarkable ability to cooperate than humans;

- artificial intelligence and machine learning are increasingly used to analyze human behavior to predict user preferences automatically and when they need it;

Artificial intelligence and machine learning are used in various industries.

A valuable and interesting review by the Committee on Artificial Intelligence (established by the Consulate of Europe in September 2019 and called CAHAI) on the use of artificial intelligence in the fight against coronavirus 19, where artificial intelligence is viewed through the prism of successful business cases in many aspects, including the contribution of artificial intelligence to drug discovery, knowledge sharing, monitoring and predicting the evolution of the pandemic, assisting medical personnel, and a population control tool.

For example, in Italy, the first six medical robots work in a Varese, Lombardy hospital. The humanoid mechanisms do part of the work to reduce the contact between doctors and the infected: they monitor patients' condition, take tests, and ensure remote communication between doctors and patients.

The US has created a robot nurse to analyze blood and insert catheters into blood vessels. During experiments, the robot showed better results than real nurses. On average, nurses make mistakes in 20% of cases, and if a person has terrible veins, the number of errors can reach 50%. The robot's results were 3% and 13%,

respectively. It uses infrared and ultrasound imaging to locate blood vessels, recognize the type of vessels, and estimate their depth. Artificial intelligence can work autonomously, without human assistance, and give injections to humans and animals (Глибовець, 2002).

Along with the potential of technology comes the potential for harm. AI-powered software often relies on a one-size-fits-all approach to providing feedback or answering questions.

In the case of LLMs such as Chat-GPT, the software relies on customized prompts to generate conclusions. These results, while constantly evolving, do not adapt to the input of that particular user. Artificial intelligence does not recognize the previous user or consider that user's search history or preferences. Therefore, every time a user accesses an LLM, they must do so as if they were a stranger.

Another issue is the usability of the product. Many of these AI-enabled technologies rely on touchscreens, so those with difficulty with touchscreen interfaces may be frustrated by the lack of accessibility options.

Artificial intelligence, just like humans, is prone to making mistakes. One of the most common mistakes artificial intelligence makes occurs when a model tries to refer to facts or events that never actually happened, a phenomenon known as 'hallucination.' When these hallucinations occur, humans often fail to notice them because the AI model provides false information alongside accurate and factual data (Субботін, 2008).

While artificial intelligence can be an invaluable tool for learning, one of its most significant drawbacks is its lack of interaction with real people. Even though our world is becoming increasingly digital, communicating and getting along with others is still essential for normal functioning. Artificial intelligence answers the question: How do you get the job done? However, involving a human to collaborate on the task is still necessary.

When users rely more and more on software, it quickly becomes a detriment to their learning.



A typical example is ChatGPT. The viral tool has been accepted and used responsibly by many. Still, the AI language model has become a tool for faster cheating with a slightly better vocabulary for many others. Students are trying to pass off AI-generated work as their own, but is this a good thing?

An easy way to combat non-thinking is to reintroduce collaboration in the classroom. For example, instead of asking students to write a paper to take home, you can assign a presentation in class. Students can research in and out of the classroom but should rely on their thinking skills, not artificial intelligence.

So, based on the above, we can conclude that artificial intelligence has advantages and disadvantages. To maximize the benefits of artificial intelligence, it is necessary to introduce appropriate regulations and develop ethical standards for using this technology. It is important to remember that a responsible approach to the development and use of artificial intelligence will help to avoid many dangers and make this tool a powerful tool for creating a better future.

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### **Muliavka D. O. OPTIMIZING MANUFACTURING PROCESSES WITH ARTIFICIAL INTELLIGENCE**

*Language Advisor – Senior Lecturer Tkachenko S.V.*

Artificial intelligence is becoming a key component of modern technological development, transforming various sectors of the economy. From healthcare to finance, agriculture to manufacturing, AI is being applied across many fields,

improving processes, reducing costs, and increasing efficiency. Its implementation in industry, in particular, holds significant potential, as automation and optimization have become essential for achieving high productivity and competitiveness. In this article, we will explore how artificial intelligence is transforming the manufacturing industry by analyzing its impact on automation, resource optimization, and improving the efficiency of production management processes.

The development of artificial intelligence is often compared to the invention of the steam engine, which in the 18th century sparked the Industrial Revolution. This comparison seems entirely fitting, as digital technologies and AI today have the potential to directly enhance manufacturing efficiency. Although this technology is just beginning to enter the mainstream, early research indicates that its implementation can increase productivity across various industries by 10-60%. The industrial AI sector is growing rapidly, and there is no doubt that manufacturers will increasingly turn to AI technologies to optimize costs, boost operational efficiency, and strengthen supply chains.

The role of artificial intelligence in manufacturing is becoming increasingly significant. AI technologies, such as machine learning, are used to predict equipment failures and prevent breakdowns, enabling the optimization of maintenance schedules and ensuring timely servicing for every machine. With the help of computer vision systems and IoT sensors, quality control processes can be fully automated, reducing defects and identifying the root causes of production issues.

Machine learning and deep learning algorithms are also widely applied to optimize supply chains, forecast demand, manage inventory, and plan production and logistics. Combined with robotics, AI paves the way for minimizing human involvement in physical processes, reducing human error risks, and enhancing workplace safety. Generative AI supports industrial design tasks, such as creating

new products, materials, and components, offering designers optimized templates for project development. (Wilks, 2019, p. 6)

In HR and personnel training, AI facilitates the creation of effective educational materials, competency assessments, and improvement of corporate communication. In marketing and analytics, machine learning algorithms analyze markets, study user behavior, develop personalized offers, and aid in the creation of new products and services. AI also plays a key role in customer support, with speech and voice recognition technologies improving service quality, while advanced chatbots enable near-total automation of support processes. (Kelleher, 2019, p.113)

AI advancements in areas like natural language processing (NLP), computer vision, and speech recognition demonstrate its ability to work with texts, images, and audio, delivering precision and speed in data processing. For instance, deep learning and neural networks handle large volumes of unstructured data effectively, supporting applications such as machine translation, search engines, and image analysis. Computer vision, in turn, analyzes visual information to perform tasks like facial recognition, environmental monitoring, and quality control in production. (Wilks, 2019, p. 46)

Generative technologies in AI are capable of producing new content, including text, visuals, and multimedia, based on analyzed data. While it is challenging to predict which technologies will dominate the future, their competitive advantages are already evident today. (Jones, 2024, p. 93)

Integrating artificial intelligence into the industrial sector unlocks new possibilities and offers numerous benefits for manufacturers. AI significantly shortens production cycles and automates repetitive tasks, such as assembly, quality control, packaging, and product transportation, thereby enhancing efficiency and productivity. It also minimizes costs and risks by preventing equipment failures, reducing defects, and decreasing waste production, making manufacturing processes more environmentally friendly.

Machine learning facilitates the development of products tailored to modern market demands and consumer preferences while simplifying the integration of new materials and technologies into production. AI algorithms analyze large datasets to identify optimal solutions, forecast trends, and create simulations that help manufacturers adapt to changing market conditions and optimize operations. (Moroney, 2020, p. 217)

AI reduces the impact of human error by mitigating risks associated with mistakes or negligence and eliminates the need for workers in hazardous environments. Additionally, automating customer service with AI improves service quality by enabling faster query processing, providing relevant information, and offering personalized products and recommendations.

Artificial intelligence has become an integral part of modern industry, particularly in sectors such as mechanical engineering and electronics. According to research by Capgemini, the most popular application of AI is predictive maintenance, which involves analyzing data to forecast potential equipment failures and assess the condition of industrial assets. This application accounts for 29% of all AI implementation cases. Alongside this, other areas such as computer vision and generative design are rapidly evolving, showcasing new opportunities in manufacturing. (Jones, 2024, p. 232)

One notable example is Foxconn, the world's largest OEM electronics manufacturer. The company utilizes Cloud Visual Inspection AI, a platform developed by Google in 2021, to enhance product quality control. This computer vision technology significantly reduces the number of defective products, helping Foxconn minimize warranty claims and avoid expenses related to returns, replacements, repairs, or waste disposal. Experts estimate that quality assurance costs can consume 15-20% of sales revenue for complex products, making such solutions highly impactful. (Jones, 2024, p. 234)

Automaker BMW employs AI extensively in its factories for quality control, logistics coordination, and maintenance optimization. By using IoT sensors and

data analytics, the company has transitioned from traditional scheduled maintenance to a condition-based approach. This reduces downtime, optimizes resource usage, improves staff productivity, and lowers overall costs.

Nissan, another leading automaker, integrates AI into the design process to enhance product quality and accelerate the launch of new models. The company has developed an AI tool capable of instantly predicting the aerodynamic characteristics of a vehicle design. While traditional methods require complex calculations on powerful workstations over several days, Nissan's AI model delivers highly accurate results within seconds, greatly expediting the development cycle for new designs.

It is impossible to ignore the impact of AI on industry, as it will become a key driver of labor productivity growth in the coming years. Although there is still no comprehensive data on its effect on manufacturing, AI tools already provide businesses with significant advantages: automation, precise quality control, improved safety, as well as new opportunities in design, marketing, and service. Not all companies have the resources or expertise to implement AI on their own, but they can strengthen their position by collaborating with external IT teams that have the necessary technologies and experience.

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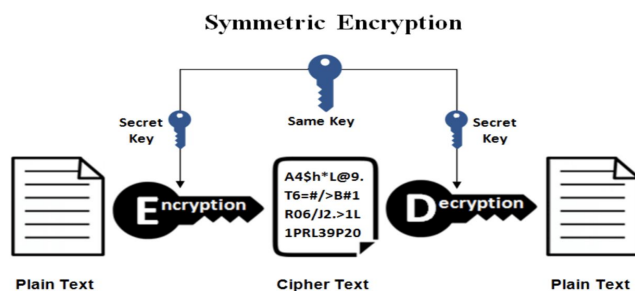
**Nasatov O. I.**  
**INNOVATIVE APPROACHES TO ENSURING INFORMATION  
SECURITY IN C# LANGUAGE**

*Language Advisor – CandSc (Education), Assoc. Prof. Borzenko O. P.*

In modern digital world, where security threats are becoming increasingly relevant, there is a need to implement reliable data protection and information security systems in software. One of the innovative approaches to ensuring security is the use of encryption and access control methods in applications created in the C# language.

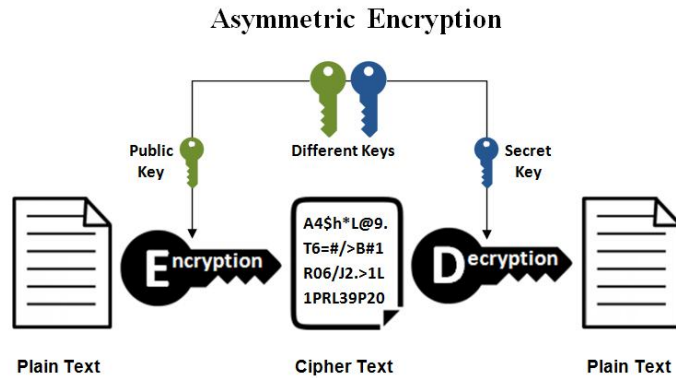
One of the key aspects of system security is the use of reliable encryption algorithms to protect confidential data. C# provides various encryption methods for this, including symmetric and asymmetric encryption, as well as hashing, which allows for a high level of data security in any application.

The basic idea of encryption is to transform information into a form that is inaccessible to unauthorized access. For example, when handling sensitive data such as passwords or payment information, C# provides the ability to use AES (symmetric encryption) algorithms, as shown in Figure 1.1 (SSL2BUY, 2010).



*Figure 1.1 – AES (symmetric encryption)*

And also, RSA (asymmetric encryption) is shown in Figure 1.2, which allows you to effectively protect data and store it in a secure form (SSL2BUY, 2010).



*Figure 1.2 – RSA (asymmetric encryption)*

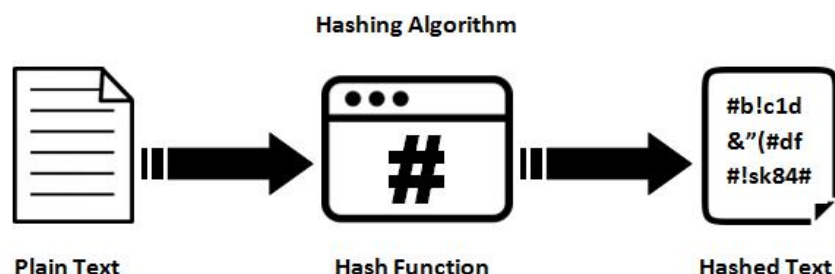
One of the important aspects of a security system is data access control. C# provides authentication and authorization tools that allow you to determine who has access to certain information. By storing access information in a secure database, developers can control the access level for each user, reducing the chance of information leakage (SSL2BUY, 2024).

In addition to encryption, C# offers the ability to hash data using algorithms such as SHA (Secure Hash Algorithm), passwords can be stored in hash form, making them inaccessible to recovery in their original form. This approach increases application security and reduces the risk of password theft (Wikipedia, 2024).

For hashing, C# uses libraries that support various hashing algorithms such as SHA-1, SHA-256, SHA-384, and SHA-512. These algorithms provide different levels of reliability and performance, allowing developers to choose the appropriate one for a particular case.

One of the important features of hashing is that it is a one-way process: it is impossible to restore the original data based on the hash. This makes hashing ideal for storing confidential information such as passwords. During authentication, the application compares the hash of the password entered by the user with the already stored hash. If the hashes match, the user is considered authenticated.

Another common practice is the use of salted hashing. Salt is random data added to the password before hashing. This helps to avoid attacks by pre-computed hash tables (rainbow tables), which increases the hash stability (Microsoft Learn, 2022).



*Figure 1.3 – SHA (Secure Hash Algorithm)*

A comparative analysis was carried out, the results of which are presented in Table 1.1.

*Table 1.1 – Comparative characteristics of systems*

Criterion	Traditional methods	Modern methods in C#
Encryption	Basic algorithms	AES, RSA
Password storage	Plain text	Hashing (SHA)
Access control	Manual control	Automated authentication and authorization
Communications security	No encryption	SSL/TLS
Vulnerability to attacks	High	Minimized through encryption and session protection
Data processing efficiency	Depends on the system	Increased due to automation and algorithms



Disadvantages of safe methods in C#:

- Implementation costs: Implementing encryption and access control can require significant resources and effort.
- Technical complexity: Some of the methods, especially asymmetric encryption, are more difficult to set up.

With strong protections, encryption and access control in C# helps reduce the risks of data leakage, helps ensure information confidentiality and protects systems from unauthorized access. With the constant threats emerging in the digital environment, it's important to implement these security tools at all application levels.

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**Novoseletska K.S.**  
**ENHANCING ACCESSIBILITY IN HUMAN-COMPUTER INTERACTION:  
STRATEGIES AND TECHNOLOGIES**

*Language Advisor – Lecturer Lukianenko N.M.*

As technology becomes integral to daily life, ensuring accessibility for individuals with disabilities is essential. This paper examines the current state of human-computer interaction (HCI) design, focusing on strategies and technologies that enhance accessibility. By analyzing various methodologies and tools, we propose a framework for creating inclusive digital environments that cater to diverse user needs.

Human-computer interaction (HCI) has evolved significantly, but accessibility remains a critical challenge. The World Health Organization estimates that over a billion people worldwide experience some form of disability (WHO, 2021). As digital platforms proliferate, the need for accessible design becomes urgent. This article reviews key strategies and technologies aimed at improving accessibility in HCI, highlighting successful implementations and areas for further research.

Accessibility in HCI is essential for legal compliance and ethical considerations. Laws such as the Americans with Disabilities Act (ADA) and the Web Content Accessibility Guidelines (WCAG) mandate accessible services (Bourguignon, 2019). Beyond compliance, there is a strong business case for accessibility; individuals with disabilities represent a significant market segment, with an estimated purchasing power exceeding \$490 billion in the U.S. alone (Johnson, 2022).

User-Centered Design (UCD). UCD emphasizes involving users throughout the design process. Engaging individuals with disabilities helps identify specific needs and preferences (Bourguignon, 2019). Techniques such as user interviews, usability testing, and iterative design lead to more inclusive outcomes. Companies like Microsoft and Google have successfully implemented UCD by involving diverse user groups in their design processes, resulting in improved products.

**Responsive Design Principles.** Responsive design techniques adapt content to various screen sizes and orientations, ensuring usability across devices (Bradley, 2020). Designers should prioritize fluid grids, flexible images, and CSS media queries to create adaptable interfaces.

**Assistive Technologies.** Incorporating assistive technologies is vital for making HCI accessible. Tools such as screen readers and voice recognition software significantly enhance usability for individuals with disabilities (Johnson, 2022). Ensuring compatibility with these technologies requires adherence to standards like WCAG.

**Inclusive Content Creation.** Content creators play a vital role in ensuring accessibility. This includes using clear language, descriptive alt text for images, and video captions (Lee, 2023). Organizations can provide training on accessibility best practices to support content creators.

**Training and Awareness.** Educating designers and developers about accessibility is crucial. Workshops, online courses, and certification programs can provide essential knowledge (Taylor, 2022). Creating a culture of accessibility within organizations can lead to more inclusive products.

#### Technologies Enhancing Accessibility.

**Artificial Intelligence (AI).** AI has the potential to revolutionize accessibility in HCI. Machine learning algorithms can analyze user behavior to provide personalized experiences (Nguyen, 2021). For example, AI-driven chatbots can assist users with disabilities in navigating websites. AI can also automate the generation of alt text for images, improving the accessibility of visual content.

**Augmented Reality (AR).** AR applications can enhance the accessibility of physical spaces by providing contextual information. For instance, AR can guide individuals with visual impairments through unfamiliar environments using audio cues and haptic feedback.

Virtual Reality (VR). Recent advancements aim to make VR experiences more inclusive. Designing VR environments that accommodate diverse physical abilities can offer therapeutic benefits for individuals with disabilities.

### Challenges in Implementing Accessibility.

Despite the growing awareness of accessibility, several challenges persist:

**Budget Constraints.** Organizations often view accessibility as an additional cost rather than an investment, hindering inclusive product development.

**Lack of Awareness and Training.** Many designers and developers lack sufficient training in accessibility best practices, leading to unintentional oversight.

**Rapid Technological Change.** The fast-paced nature of technological advancements can make it challenging to keep accessibility standards up to date.

**Diverse User Needs.** The diversity of disabilities and user preferences complicates the design of universally accessible products.

### Future Directions

**Collaborative Design Approaches.** Future accessibility efforts should focus on collaboration among designers, developers, and users with disabilities. Co-design processes can lead to innovative solutions.

**Continuous Evaluation and Feedback.** Organizations should establish mechanisms for continuous evaluation of their products' accessibility features. Regular user testing and feedback loops can help identify areas for improvement.

**Advancements in AI and Machine Learning.** Future research should explore innovative applications of AI that address specific accessibility challenges.

**Legislation and Policy.** Policymakers should promote accessibility by enforcing regulations and incentivizing organizations to prioritize inclusive design.

Enhancing accessibility in human-computer interaction is both a moral imperative and a pathway to innovation. By employing user-centered design, responsive principles, assistive technologies, and inclusive content creation, we can create digital experiences that cater to all users. Continued research and development in AI, AR, and VR technologies hold promise for further improving

accessibility. As we move forward, it is crucial to maintain a commitment to inclusivity, ensuring that no one is left behind in the digital age.

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**Oleynik D. D.**

### **PROSPECTS AND RISKS OF ARTIFICIAL INTELLIGENCE DEVELOPMENT**

*Scientific Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*  
*Language Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*

Nowadays, technology is only moving forward and developing more and more every year. Even 20 years ago, people could not imagine where society would go. Nowadays, everyone uses new technologies and cannot imagine their lives without them. One example of new technologies is artificial intelligence.

Artificial intelligence (AI) is one of the most transformative technologies in the modern world, affecting various areas of life - from business to healthcare, entertainment education. Its introduction is changing individual industries and how we interact with technology, society, and even our lives.

Artificial intelligence (AI) is a branch of computer science that deals with creating systems and programs that can perform tasks that require intelligence, including learning, pattern recognition, speech understanding, decision-making, and others. AI aims to create algorithms and programs to process large amounts of data, draw conclusions, and make decisions based on them, often imitating human thinking.

AI can be narrow (or weak), specializing in certain specific tasks (e.g., image recognition), or general (or firm), capable of performing a wide range of functions, just like humans.

It is a program that can solve problems, answer questions, or perform tasks. It is a way to make a computer or software think like a human brain. The most famous services are ChatGPT, Siri, and Midjourney. These applications have a lot of fans, but some people don't like them. Like every server, they have their pros and cons.

Firstly, one of the advantages is that artificial intelligence can perform monotonous, repetitive tasks, freeing people from unnecessary movements. Artificial intelligence is about accuracy and speed, and programs can process much information with fewer errors. AI allows automating many tasks that previously required human intervention. Analytics and big data processing are just a few examples of where AI can be used.

Secondly, AI helps with learning: it corrects mistakes, helps detect plagiarism, simplifies information search, and can instantly provide learning materials in any field.

Thirdly, AI's rapid development and new inventions are already helping to make full use of it. One is self-driving cars, such as Tesla, equipped with sensors, cameras, and AI algorithms.

Artificial intelligence has no emotions. On the one hand, this is good because it has rational abilities that influence more accurate and correct decisions. On the other hand, it does not have the same range of emotions as a human. It will not

have a creative approach, but some features will distinguish it from others. For example, if a report is made with the help of artificial intelligence, it will be apparent, structured, and fully covered without any emotion or creativity (Головко, 2024).

The fact that AI has no emotions is a disadvantage but not the worst thing that can happen. One of the main problems shortly is the risk of rising unemployment. Already, robots have begun to replace people in some areas, such as customer service and small jobs at enterprises. Areas that can be easily automated and do not require human intervention will soon be replaced by robots.

With the advent of automation, people are becoming lazy because routine tasks have become more accessible. With the development of modern technology, people don't have to memorize and assimilate as much information, so they can start to put less stress on their brains than before.

The danger of AI is that it can completely replace humans and lose control of actions, which will most likely lead to dire consequences. However, whether this is true or not is currently unknown because robots are already starting to replace some professions, which is becoming increasingly common every year. Now, all that remains for people is to follow the development of technology.

So, it should be noted that artificial intelligence will never be able to replace human intelligence. However, development is rapidly progressing; AI makes social life more accessible, and it can store an infinite amount of data and process it continuously. People will not be able to predict how far the development of artificial intelligence can go, but it will never be better than human intelligence.

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**Oliinyk V. V.**  
**USES AND DANGERS OF ARTIFICIAL INTELLIGENCE**

*Language Advisor – Senior Lecturer Tykhonova M.Ye.*

As the development of artificial intelligence (hereinafter may be written as “AI”) accelerates, so does the possible threat from it. Cybersecurity is facing increasingly complex challenges as technology evolves. Deepfakes, phishing, and IoT hacking are among the most pressing issues today, with each posing unique risks to individuals, organizations, and governments. This article will discuss these 3 areas of fraud in which artificial intelligence is used, what are the ways to protect against attackers, the latest technologies in these areas, and statistics.

First and the most powerful tool that is loved by miscreants is Deepfake. Deepfakes are artificially created videos or audio recordings with usage of AI, particularly deep learning algorithms, to create hyper-realistic, however fake content. These fakes are often so convincing that it becomes difficult to differentiate them from real media. Deepfakes have found applications in both positive and negative contexts. On the positive side, they are used in the cinematic industry to de-age actors or recreate historical figures for educational purposes. However, their harmful uses dominate benefits from them. Criminals use deepfakes for spreading misinformation, committing fraud, and conducting blackmail. For example, deepfake technology has been used to mimic CEOs' voices, tricking employees into transferring large sums of money, or to mimic someone's relatives' voices to ask for money or to create a fake kidnapping situation and only then ask for money to “release” their relatives. This scheme is well-working, because putting someone in such a situation where every second is to count, and stress pressure the person is a well-planned psychological game.

It can be questionable how do criminals find examples of someone's voice, but this is not that hard to do. There is maybe no one that keeps himself completely anonym. Criminals can be anyone and even talking to strangers can be dangerous nowadays, especially if we talk about the internet, so every person with whom



potential victim goes to same one cooking class, works with or just contacts on the street can be taking samples of victim's voice and that use it against victim's relatives. While this is possible, it is very rare, what you really need to worry about is online and social media snooping. Every of us leaves an information trail and all what every of us left can be stolen. This is not hard to find someone on social networks, to track their location with them and to find everyone who this person knows. There's a good quote that epitomizes how deliberate our actions on the Internet should be: "The Internet remembers everything." And it is true that whatever we post, send, write or view will always be stored somewhere on the servers, even after we delete those files, the internet remembers everything, and everyone can use this.

Artificial intelligence plays a critical role in creating and combating deepfakes. Generative Adversarial Networks (GANs) are commonly used to create these forgeries. GANs consist of two competing networks: one generates fake content, while the other evaluates its authenticity, leading to rapid improvements in the quality of deepfakes. Meanwhile, AI-driven detection tools analyze facial movements, lighting inconsistencies, and other subtle clues to identify manipulated content.

To combat the misuse of deepfakes, several strategies have been developed:

1. Detection Tools: AI-based software like Deepfake Detection Challenge (DFDC) tools analyze visual artifacts, irregular facial expressions, and inconsistencies in video/audio to identify fakes.
2. Blockchain Technology: Authenticating digital content origins with blockchain ensures traceability and reduces forgery risks.
3. Legal Measures: Laws like the U.S. DEEPFAKES Accountability Act penalize malicious use.
4. Awareness Campaigns: Educating individuals about recognizing suspicious content reduces victimization risks.

The second most popular way to scam people is “Phishing”. It involves tricking individuals into revealing sensitive information such as passwords or credit card details by impersonating trusted entities. Attackers commonly use fake emails, websites, or messages to deceive their victims. Phishing tactics have evolved significantly since AI technologies became accessible to everybody. Email phishing, where attackers impersonate banks or social media platforms, remains widespread. Smishing (phishing via SMS) and vishing (phishing via voice calls) are becoming increasingly popular. Especially with the usage of earlier mentioned deepfakes. Targeted attacks, known as spear phishing, use personal details, that are found in the same way as information to make samples for deepfakes, to build trust, making them even more effective. Typically, attackers send thousands of emails every day to different emails with the hope that someone will fall for it. The most popular types of emails that work best are those that say that a rich man is on the run and asks for your card to transfer a large amount of money to it and not get caught, or that a lonely but rich father with a child is moving and wants you to meet him, and he also says he will transfer money for you to buy a car and pick him up from the airport. It may seem that no one will fall for such nonsense, but these letters come after several months of correspondence and so-called “warming up”. During this time, false relationships and trust are built between the victim and the fictitious character. There are also letters with simple content, where it is said that you won the lottery, and you are asked to send someone the number of your card and you will get the prize. But even such methods work, since they are used in such quantities.

AI has become a double-edged sword in this domain. While it empowers attackers to create highly personalized and convincing phishing messages, it also helps defenders by developing email filters and anomaly detection systems that identify and block phishing attempts.

Going to the opposition, phishing mitigation involves:

1. AI Filters: Email providers use machine learning to flag suspicious emails.
2. Two-Factor Authentication (2FA): Adds a layer of security beyond passwords. This is beneficial in situations where you realize what you've done and can prevent any further damage, or you've noticed that someone has stolen your data.
3. Anti-Phishing Software: Tools like Norton Anti-Phishing help detect phishing sites.
4. Training Programs: Teaching users to identify phishing tactics significantly reduces effectiveness.

The third thing that we need to be careful with is IoT. The Internet of Things (IoT) connects billions of devices, from smart home appliances to industrial machinery, enabling seamless data exchange and automation. IoT devices are often hacked due to weak passwords, outdated software, or vulnerabilities in their design. Hackers exploit these flaws to gain unauthorized access, intercept communication, or take control of devices. For example, botnet networks of compromised IoT devices are frequently used to launch massive Distributed Denial of Service (DDoS) attacks.

The consequences of IoT hacking can be severe. Personal data from smart home devices can be stolen, industrial IoT systems can be disrupted, and financial losses can mount if connected systems, like ATMs, are compromised. However, speaking about everyone and not companies, this can be the worst what you've experienced. We won't even notice if our data is stolen, but when we get an email with a video or photo from a camera inside our house, that's the only time we'll realize something. The power and effectiveness of such hacks is that they can be done quickly and unnoticed by the user. Although the attacker gets access to information that will help to blackmail or threaten the victim, extorting money from him.

Securing IoT devices includes:

1. Regular Updates: Ensuring firmware and software are up to date, to make it easier for security algorithms to work and detect threat.
2. Strong Passwords: Avoiding default or easily guessed credentials.
3. Network Segmentation: Isolating IoT devices from critical systems limits damage.
4. Anomaly Detection Systems: AI-based monitoring flags unusual device activity.

To summarize, there are so many dangers of the internet and artificial intelligence to think about right now. But don't panic too much, as the protection technologies are not standing still either and the only thing, we really need to take care of is strong and different passwords for different platforms and think before opening unfamiliar links, answering unfamiliar emails or trusting everyone on the Internet. If you stick to at least these rules, you can avoid a lot of online attacks.

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**Polupan A. V.**  
**THE WAY TO IT: WHO IS A TESTER AND WHY IS IT PROMISING**  
*Language Advisor – CandSc (Education), Assoc. Prof. Borzenko O. P.*

The profession of a software tester (QA engineer) remains one of the most popular options for entering IT. Such specialists are in demand in almost every company engaged in software development. However, competition in this market has increased significantly. If earlier basic knowledge and minimal experience were enough to start, now the requirements for Junior QA are much higher (Go It, 2023).

Despite this, software testing continues to attract many people due to the opportunity to build a successful career and earn a decent income. In this article, we'll cover the basics of testing to help you determine whether this profession is right for you.

Software testing is a process of verifying the product quality, aimed at identifying nonconformity between the actual and expected behavior of a system. The aim of testing is to minimize the number of errors and increase stability and functionality (Вікіпедія, 2024).

Testing includes:

- searching for bugs (errors in the system);
- analyzing the product's conformity with customer requirements and user expectations;
- assessing functionality, reliability, efficiency, usability, and other characteristics.

A bug is an error due to which a product does not work as intended. Examples of bugs are incorrect fare calculations in a taxi app or chaotic behavior of a character in a game (Go It, 2023).

The testing process includes:

- analyzing requirements;
- planning;
- creating test scripts;

- executing tests;
- analyzing results;
- compiling reports;
- retesting after fixing bugs.

Testing is not just "walking around the site", but systematic work. Types of software testing are:

1. Module testing is the verification of individual modules or functions of a system. It is performed at a low level along with source code.
2. Integration testing evaluates the interaction between the application's modules and services. For example, it verifies the correctness of the transfer between the database and the system.
3. Functional testing verifies the fulfillment of business requirements. The main focus is on the final results.
4. End-to-end testing simulates user behavior in the system. For example, it could be verifying a login or making a payment.
5. Acceptance testing is conducted to assess the product's conformity with business requirements. It may include performance measurements.
6. Performance testing evaluates system stability under load, response speed, and scalability.
7. Smoke testing is a quick verification of the basic functionality of the system after making changes or deploying a new build (Atlassian, 2024).

A software tester plays a key role in creating a quality product. His tasks include:

- analyzing requirements;
- creating test scripts;
- identifying errors and compiling reports;
- interacting with developers to fix problems.

To successfully work in this role, you need to have analytical skills, understand testing methodologies, know programming basics and be ready to communicate with the team (FoxmindEd, 2023).

Software testing is an in-demand and promising profession that requires attention to detail, analytical thinking and good communication skills. By starting a career in testing, you will be able to work on creating quality products that improve the lives of millions of users. If you are interested in technology and are ready to learn new things, testing could be your perfect start in IT.

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**Popov Ya.D.**  
**ROBOTIC INTEGRATION IN OUR LIVES**  
*Language Advisor – Asst. Prof. Nikiforova S.M.*

Nowadays, robots and artificial intelligence have become an integral part of our daily lives. They are used in various industries, from industrial production to medical care, and more. My presentation will explore how robotic integration is changing our lives, the benefits and challenges it brings, and the prospects for its further development.

What is robotic integration?

In my opinion, robotic integration is the process of incorporating robots and automated systems into various aspects of human activity. Robots can perform easy or complex tasks that used to require human labour. Robots are updated every day and their capabilities are constantly growing through development.

One of the most visible forms of robotic integration is industrial robots. They are used in factories to produce cars, electronics, textiles, and other goods. They are able to work faster, more accurately and more efficiently than humans, which increases productivity and reduces production costs.

They are called MANIPULATORS.

In addition to industrial applications, robots are increasingly becoming part of our everyday lives. Modern smart devices, such as robotic vacuum cleaners or artificial intelligence machines, are examples of how robotics simplify household tasks. They reduce routine and allow people to focus on more important aspects of life, such as work, study or leisure.

Robots have also found their place in healthcare. For example, surgical robots help doctors perform complex operations with greater precision. Robots can also provide faster and more accurate diagnosis of diseases and improve patient rehabilitation.

Another significant change is the introduction of autonomous vehicles. This applies to both driverless cars and unmanned aerial vehicles, known as drones.



Autonomous cars are already being tested on roads in many countries around the world, and it is predicted that they will change the way we travel by reducing the number of road accidents and optimizing traffic. We are waiting for flying cars. Drones have also found widespread use in our challenging times. They can quickly deliver bombs and supplies to the enemy, reducing the risk to our Armed Forces.

One of the biggest is the threat of job losses. Robots can replace humans in tasks, leading to a reduction in the number of jobs in certain industries. This creates a need for retraining and the introduction of new professions related to robot management and maintenance.

The integration of robots is also changing social relations and structures. Companion robots are emerging that can help the elderly or people with disabilities. They provide emotional support and physical assistance.

The integration of robotics into everyday life is transforming the way we live, work, and interact with the world. From healthcare to industry, robotics is becoming an integral part of various sectors, offering innovative solutions and reshaping traditional practices. Here's an overview of its impact:

#### 1. Robotics in Healthcare

- **Surgical Robots:** Tools like the Da Vinci Surgical System assist surgeons in performing precise, minimally invasive surgeries.
- **Rehabilitation:** Robots aid in physical therapy, helping patients regain mobility with tailored programs.
- **Elderly Care:** Robotic assistants such as companion robots provide social and physical support for seniors.

#### 2. Robotics in Industry

- **Manufacturing:** Automated systems boost production efficiency, consistency, and safety in factories.
- **Logistics and Warehousing:** Robots like those used by Amazon streamline inventory management, packaging, and delivery processes.

- Construction: Drones and robotic machinery enhance safety and precision on construction sites.

### 3. Robotics in Personal Life

- Home Assistants: Devices like robotic vacuum cleaners (e.g., Roomba) and personal AI assistants (e.g., Alexa) simplify household tasks.

- Education: Robotic kits and AI-driven tutors enhance learning, especially in STEM fields.

- Companionship: Social robots like Jibo or Miko engage with users, especially children and those with disabilities.

### 4. Autonomous Transportation

- Self-driving cars and drones are revolutionizing mobility by improving safety and reducing congestion. Delivery robots are also gaining popularity for last-mile services.

### 5. Ethical and Social Implications

- Job Displacement: Automation challenges traditional job roles, necessitating workforce upskilling.

- Privacy Concerns: The use of AI in robots raises questions about data collection and security.

- Human-Robot Interaction: Balancing emotional attachment and ethical treatment of robots is an ongoing debate.

### Future Outlook

The role of robotics in our lives will only expand as technology advances. Collaborative robots (cobots), humanoid robots, and AI-driven systems will likely integrate further into our daily routines, making tasks easier while posing new challenges to address.

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**Prudnykov M. Yu.**  
**ARTIFICIAL INTELLIGENCE**  
*Language Advisor – Senior Lecturer Lysenkova T.M*

Artificial Intelligence (AI) is a field of technology that aims to enable machines to simulate human thinking and behavior. Its goal is to create systems capable of performing complex tasks such as analyzing data, making predictions, and learning from experience. AI has rapidly evolved and is now integrated into everyday life, from voice assistants to self-driving cars and recommendation systems.

These intelligent systems adapt to new information, draw inferences, solve problems, recognize patterns, and understand language. AI represents more than simple automation, encompassing adaptive learning and decision-making processes. With its wide-ranging applications, AI is revolutionizing industries by enhancing accuracy, speed, and efficiency.

AI can be categorized into two types. Narrow AI, or Weak AI, specializes in specific tasks like voice recognition or image analysis. It excels within its limited scope but lacks general understanding. General AI, or Strong AI, remains largely theoretical and would operate at a human level, making autonomous and flexible decisions across a wide range of tasks. While Narrow AI dominates today, the pursuit of General AI continues to drive research, carrying significant implications for the future.

AI is built upon key components that enable its functionality. Machine Learning (ML) allows systems to learn from data patterns and make decisions without explicit programming. Neural networks, inspired by the human brain, process complex data inputs like images or text through layered structures. Natural Language Processing (NLP) enables computers to understand and generate human language, facilitating seamless interaction between humans and machines. Computer vision interprets visual data, powering applications such as facial recognition and medical imaging. Robotics uses AI to enable robots to make decisions and adapt in dynamic environments, contributing to industries like manufacturing and logistics.

The applications of AI are transformative across various fields. In healthcare, AI-powered tools analyze medical data to provide faster and more accurate diagnoses and assist doctors in recommending treatments. In finance, AI is used for real-time fraud detection, predictive analytics, and algorithmic trading. The automotive industry relies on AI for self-driving cars, which interpret their surroundings and make real-time decisions. AI chatbots enhance customer service

by providing 24/7 support and handling common queries. In gaming, AI characters adapt to player behavior, creating more immersive and challenging experiences.

AI relies on sophisticated techniques to achieve its capabilities. Machine Learning employs supervised, unsupervised, and reinforcement learning methods to identify patterns, predict outcomes, and make data-driven decisions. Deep Learning, a subset of Machine Learning, uses neural networks with multiple layers to recognize intricate patterns in large datasets, such as identifying objects in images or translating languages.

Despite its promise, AI faces several challenges. The quality of data is critical, as inaccuracies or biases can lead to flawed results. Interpretability is another challenge, as complex models, especially in deep learning, often function as “black boxes,” making it difficult to understand how decisions are made. Security concerns arise from the potential manipulation or misuse of AI systems, necessitating safeguards to ensure ethical and secure deployment.

The future of AI is marked by exciting trends. Autonomous systems, including self-driving vehicles and drones, are advancing rapidly, becoming more self-sufficient across industries. Human-AI collaboration is emerging as a central focus, with AI enhancing human abilities in healthcare, education, and creative fields. Ethical AI is gaining importance, emphasizing the need for fairness, transparency, and accountability in AI-driven decisions to align technology with human values.

Artificial Intelligence represents an opportunity to innovate for a better future. By exploring new frontiers and pushing the boundaries of AI, we can address pressing global challenges in healthcare, education, environmental sustainability, and economic growth. Through thoughtful innovation and responsible development, AI has the potential to enhance human well-being, improve productivity, and create opportunities for social progress. By advancing AI in ways that are ethical, inclusive, and aligned with shared values, we can shape a future where technology benefits all of humanity.

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**Prudnykov M. Yu.**

### **CYBERSECURITY DURING MILITARY HOURS: A KEY TO MODERN WARFARE**

*Language Advisor – Senior Lecturer Lysenkova T.M*

In today's digital world, cybersecurity plays a huge role in military operations. During military hours—times when forces are actively engaged or on high alert—it's super important to keep digital systems safe. Cybersecurity in these moments isn't just about protecting secret data; it's also about making sure everything works smoothly and missions don't get interrupted.

#### Why Cybersecurity Matters in the Military

Modern armies use all kinds of high-tech tools, like satellite communications, drones, and GPS. While these tools are really useful, they also come with risks. Hackers can attack these systems, which could:

- **Disrupt Communications:** Imagine if soldiers couldn't talk to their commanders—it would cause chaos.
- **Mess with Data:** If someone changes important information, it could lead to big mistakes in planning.
- **Shut Down Systems:** Attacks on things like power grids or supply chains can bring everything to a halt.

#### Big Cyber Threats in Military Operations

There are several ways cybercriminals try to mess with military systems, such as:

1. Spying: Hackers try to steal secret plans or troop movements.
2. Network Overload: By flooding military networks, they can make them stop working.
3. Malware and Ransomware: These can damage systems or lock them up until a ransom is paid.
4. Tricking People: Using fake emails or other tricks, hackers can get access to secure systems.

#### How to Stay Safe in Cyberspace

To fight these threats, the military needs a strong cybersecurity plan. Some useful strategies include:

1. Better Encryption: Using strong codes to keep communications private.
2. Trust No One: Having strict rules about who can access systems.
3. Watch Systems Constantly: Using smart technology to spot problems as they happen.
4. Train Everyone: Teaching people to recognize cyber threats, like fake emails.
5. Have Backups: Keeping spare systems ready to go if the main ones are attacked.

#### What We've Learned from Recent Conflicts

Recent wars have shown how important cybersecurity is. For example, in the Russia-Ukraine war, hackers targeted communication systems, showing just how dangerous cyberattacks can be. Many countries are now treating cybersecurity as just as important as traditional weapons because a single attack can change the outcome of a battle.

#### Conclusion

Cybersecurity is a big deal during military hours because it protects the systems and information that soldiers rely on. Without it, even the best equipment and plans can fail. That's why countries need to keep improving their cybersecurity strategies. At the end of the day, it's not just about having strong weapons but also

about making sure those weapons and systems can't be hacked. Cybersecurity is like the invisible armor that keeps everything running smoothly, and it's something the military can't afford to ignore.

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**Rudenko R. M.**

### **SMART STOPS IN UKRAINE – A STEP TOWARDS A SMART CITY**

*Language Advisor – CandSc (Education), Assoc. Prof. Borzenko O. P.*

The article examines the concept of smart stops as a key element of smart cities. It analyzes modern technologies, including the Internet of Things, big data and artificial intelligence, as well as their impact on optimizing traffic flows and increasing passenger comfort. The experience of implementing smart stops in Kyiv and abroad is presented, the main challenges are identified and recommendations are offered for adapting technologies to the conditions of Ukraine.

Modern cities face numerous challenges in the field of transport: traffic jams, inconvenience for passengers, low level of information accessibility, as well as significant environmental impact of the transport system. All this creates a need for innovative solutions that optimize the operation of public transport.

In the process of writing the article, a number of scientific papers and articles devoted to the topic of smart cities, future technologies and the implementation of smart stops were analyzed. Among the key studies, the following authors can be distinguished: Ivanenko O. S., Petrenko L. V., Sydorenko O. V., Marchenko I. P., Paliychuk S. M., Kumar J., Wilson M. These works show that the development of smart cities is one of the key trends of urbanization in the 21<sup>st</sup> century. As the urban



population increases, there is a need to implement innovative solutions. One such solution is smart stops, which have proven effective in countries with developed transport systems such as Singapore, South Korea and Germany.

According to the State Statistics Service, in the country's large cities the level of public transport use exceeds 60%. However, the infrastructure often remains outdated, which creates inconvenience for passengers and reduces the efficiency of the transport system. In a world where technology is entering every aspect of our lives, smart stops are becoming not just places to wait for transport, but real mini-hubs for interaction between city residents and urban infrastructure (Петренко, 2021).

Particular attention should be paid to the use of the Internet of Things (IoT). For example, motion sensors help track passenger flows, which allows city authorities to redistribute resources and quickly respond to changes in order to accommodate additional transport (Kumar, 2020).

Big data analytics and artificial intelligence are equally important. Based on data about people's movements, it is possible not only to improve routes and schedules, but also to predict where more passengers will be in the future to adapt the infrastructure in advance and reduce the load on the most popular routes.

And, of course, mobile applications are the connection between a person and the system. Today, we can not only find out when the bus will arrive, but also see how busy it is and whether there is Wi-Fi (Wilson, 2024).

Smart stops are not only about technology, but also about economics. Analysis shows that such solutions reduce operating costs: less traffic jams mean less fuel and vehicles wear and tear. The environmental benefits are also obvious – this is a reduction in CO<sub>2</sub> emissions due to route optimization and the use of environmentally friendly vehicles, such as electric buses, trams, and trolleybuses (Іваненко, 2020).

In Ukraine, pilot projects of smart stops have already been implemented in Kyiv. These stops are equipped with Wi-Fi, information boards and USB chargers.

The experience of foreign countries, such as the Netherlands and South Korea, shows that the implementation of smart stops is possible only with the cooperation between the state, business and society (Сидоренко, 2023).

Smart stops are the future that has already arrived. As they say, a smart stop is just the beginning. Who knows? Maybe in a few years we will be talking about “smart routes” that will choose the optimal direction to minimize travel time. In the meantime, we need to take minimal steps towards a smart city so that technologies increasingly work for the benefit of society.

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**Shagiyan R. S.**

### **THE IMPACT OF CLOUD TECHNOLOGY ON EDUCATION**

*Language Advisor – Asst. Prof. Chevychelova O. O.*

Cloud technology has truly transformed many sectors, and education is no exception. It has revolutionized the way schools and universities manage their data, deliver learning materials, and engage with students, creating a more flexible and

accessible learning environment. This article explores the wide-reaching impact of cloud technology on education, looking at the benefits, challenges, and what the future might hold.

One of the most significant advantages of cloud technology is the way it enhances accessibility. Cloud-based platforms break down geographical boundaries, allowing both students and educators to access resources and course materials from anywhere with an internet connection. This is especially useful in remote learning environments, where students can participate in lessons and access materials without needing to be physically present. This "anytime, anywhere" access allows students to study at their own pace, adapting to their individual learning styles and schedules. For example, during the COVID-19 pandemic, cloud technology played a crucial role in keeping education going, allowing for e-learning and ensuring that lessons continued despite the crisis. Cloud-based solutions also offer helpful features like text-to-speech and screen readers, which make education more accessible to students with disabilities.

Cloud technology also creates a more collaborative learning environment. Tools such as Google Workspace and Microsoft 365 allow students to work together in real-time on documents, spreadsheets, and presentations, encouraging teamwork and developing communication skills. These tools promote active collaboration, helping students prepare for the team-oriented nature of modern work environments. In addition, platforms often have integrated communication tools, like video conferencing and messaging, which help students and teachers stay connected, even in virtual settings. This leads to faster feedback, more personalized instruction, and a stronger sense of community, which is especially important when students are dispersed across different locations.

In addition to enhancing teaching and learning, cloud technology streamlines administrative tasks within educational institutions. Cloud-based systems can manage everything from student records and attendance to grading and admissions, all much more efficiently than traditional paper-based methods. By automating

these processes, educators and staff have more time to focus on what really matters – teaching, supporting students, and developing curricula. Cloud solutions also provide valuable data and analytics, offering insights into student performance and institutional effectiveness. These insights help schools and universities make more informed, data-driven decisions.

Cloud technology can also save educational institutions a lot of money. Instead of investing heavily in physical IT infrastructure and expensive software, schools and universities can subscribe to cloud services, which offer scalable solutions that are tailored to their needs. Institutions only pay for what they use, which is particularly advantageous for smaller schools with limited budgets. This pay-as-you-go model allows even smaller institutions to access advanced technology and computing power that would otherwise be out of their reach. Moreover, using cloud services reduces the need for large IT teams, resulting in further savings.

However, while cloud technology offers many benefits, it also presents some challenges. One major concern is data privacy and security, especially when dealing with sensitive student information. Educational institutions must ensure they comply with data privacy regulations and implement strong security measures, such as encryption and access controls, to protect student data from breaches. Another challenge is the reliance on internet access. In areas where the internet is unreliable or unavailable, students may face difficulties participating in cloud-based learning, which could widen the digital divide. Addressing these issues will be essential to ensure that every student can benefit from the advantages of cloud-based education.

Looking ahead, the future of cloud technology in education looks promising. Emerging technologies, such as artificial intelligence (AI), augmented reality (AR), and virtual reality (VR), are poised to take learning experiences to the next level. For example, AI can personalize learning by adapting content to meet the needs of individual students, while AI-powered chatbots could provide round-the-clock

support. Meanwhile, AR and VR could create immersive, hands-on learning experiences, allowing students to explore virtual environments or interact with 3D models. As these technologies develop, they will likely be integrated into cloud platforms, providing even more innovative tools for educators and students.

In conclusion, cloud technology has had a transformative effect on education, improving accessibility, fostering collaboration, and streamlining administrative tasks. While there are challenges to address, such as data security and internet access, the potential for future advancements in education is enormous. As more schools and universities adopt cloud solutions and integrate emerging technologies, they will be better equipped to meet the changing needs of students and prepare them for success in a digital world. The evolution of cloud technology promises to continue reshaping education, creating a more dynamic, personalized, and inclusive learning experience for all.

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**Skakun M. S.**  
**INFORMATION TECHNOLOGIES FOR LANGUAGE LEARNING WITH**  
**ARTIFICIAL INTELLIGENCE**

*Language Advisor – Senior Lecturer Lysenkova T.M*

In today's world, learning new languages is very important. Traditional methods of language learning work, but they have some limits. Now, with the help of Artificial Intelligence (AI), learning languages has become easier and faster. AI offers new tools that make language learning more effective and accessible.

A striking example of the use of artificial intelligence for the effective learning of a foreign language is the use of specially designed programs and applications (for example, the interactive platform MyEnglishLab from Pearson).

AI can process a lot of information and think like humans. This makes it very useful for learning languages. For example, AI can create lessons that fit your needs. If you are good at vocabulary, but not as good at grammar, AI will give you more grammar exercises. This way, you can use your study time well. AI also makes language learning available to more people. AI tutors and apps can provide good lessons and feedback no matter where you are. This is great for people who live far away or cannot pay for private lessons.

One of the best things about AI is that it can give you personalized lessons. For example, Duolingo uses AI to make lessons just tailored right for you. This way, the lessons are not too easy or too hard.

It is also worth noting the active use of the so-called speaking robots, which is quite widespread and incredibly popular.

AI tutors are always ready to help you. They can answer questions, correct mistakes, and explain things in real-time. This makes learning very flexible. You can study anytime you want, which is very useful if you have a busy schedule. AI tutors are also cheaper than private lessons with a real teacher. I use AI tutors a lot because I can study whenever I have free time. I just open my phone or laptop and start learning. This is very convenient.

AI is very good at understanding speech. AI tools can listen to how you speak and give you feedback right away. Apps like Rosetta Stone and ELSA Speak help you improve your pronunciation. They tell you how to sound more like a native speaker. AI translation tools help us talk to people who speak different languages. These tools can translate words right away, making it easier to understand each other. For example, Google Translate can translate text instantly. This is very useful when you travel and need to read signs or menus. AI translation apps can help in many situations, like asking for directions or ordering food. Microsoft Translator is another good tool that translates spoken language in real-time.

AI can also help with conversations between people who speak different languages. You can find a lot of videos on the internet where two people talked using AI. Each person spoke in their own language, and AI translated their words instantly. They understood each other perfectly. This shows how AI can connect people from different places.

Plenty of AI-powered apps make learning languages fun and effective. Apps like Babbel and Memrise use AI to create lessons that match your needs. These apps give interactive exercises and feedback, helping you learn better.

AI also makes learning fun through games. Gamified learning platforms use rewards and challenges to keep you motivated. For example, Duolingo uses points and levels to make learning like a game. Memrise uses videos and quizzes to keep you interested. AI is changing language learning by making it more personal, accessible, and fun. As AI gets better, it will bring even more new tools to help us learn languages. Start using AI in your language learning journey because it is now much easier and more enjoyable.

Artificial intelligence can significantly simplify human life, save time, money and energy.

It is also important not to forget the need for critical evaluation of generated AI products, as well as the principles of academic integrity when using them.

Students need to be prepared for a world in which artificial intelligence operates. It cannot be ignored, hoped for to disappear, or banned. Artificial intelligence will perform some of the tasks in a lot of professions. While artificial intelligence has the potential to revolutionize plenty of industries, it also raises serious ethical issues.

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**Skubanova O. O.**

**ARTIFICIAL INTELLIGENCE IN CROSS-CULTURAL  
COMMUNICATION: THE POTENTIAL BENEFITS AND DANGERS**

*Language Advisor – DSc (Education), Prof. Saienko N.V.*

Recent decades have seen a significant impact on the nature and ways of information exchange with the active introduction of artificial intelligence technologies in various fields of human activity. This process affected most types of communication, including interpersonal and inter-group (professional and international) interaction (Angelov et al., 2021).

Automatic systems, conditionally called intelligent (Morozov, 2023), have rapidly improved the accessibility, speed and quality of coaction between representatives of different cultures. The innovations have influenced almost all fields of intercultural communication – from international law to military affairs, allowing to save efforts and time of subject matter experts.

Thus, the use of neural networks in machine translation systems (Memsource, Word bee, XTM Cloud, SDL Trados Studio, Smartcat) is seriously transforming



teaching and translation activities, eliminating the need to spend time on translating symbols from one language to the other in monotyping or clichéd texts (legal, office, medical, technical documentation, media texts).

Speech and text recognition systems (Transkriptor, Siri, Winscribe; Office Lens, Adobe Scan, Win Scan 2PDF) allow for the translation of verbal texts in real time, increasing migration mobility and reducing intercultural tension among communicants.

Specialized data processing and analysis systems have a significant impact on international economic communications and marketing (Zugravu et al., 2024), such as algorithmic trade (Quantlyfly, Tradetron, AlgoTest), automatic trade decision-making and conclusion of transactions (TrendSpyder, Imperative Execution, Algoriz), analysis of consumer behavior (RFM-analysis) and algorithms for contextual advertising (Aori, Alytics, Origami), customer communication in the banking and insurance sectors (Salesforce CRM, Sales Creatio, NetHunt CRM)).

Automatic project management systems (JIRA, MS Project, Primavera) help streamline the work of global industrial and logistics chains (Burnham, 2024), increase the efficiency of multinational teams in business and the IT sphere, facilitate the directing of mass intercultural events.

Selective search and automatic personal information processing systems (BambooHR, Quinyx, PeopleForce) improve the efficiency of interaction in the international labour market (Gaines, 2024).

Text (GPT-3, Grammarly, SmartWriter) and voice (Google Text-to-Speech, Headliner Voice) generation systems are used extensively in international journalism and propaganda (Simon, 2024), and image generation (Midjourney, Stable Diffusion XL, DALLÉ2) is applied in the global game industry and cinema, creating additional information opportunities and communicative space for cross-cultural coaction (Grove, 2024).

Finally, the use of artificial intelligence (AI) algorithms to analyze nonverbal signals (Social Catfish, Spokeo, PimEyes) improves the international law system

(in particular the penitentiary system) and facilitates the work of intelligence services (Rodrigues et al., 2024).

Nevertheless, the risks associated with the introduction of AI technologies in a multinational communication environment cannot be ignored.

Thus, one of the most urgent is the issue of cybersecurity. The use of AI technologies does not just expose personal, corporate or intra-state data to a risk of leakage, but simply blurs the boundaries between sensitive and public data (Abelson et al., 2015) and at this stage does not provide guaranteed tools for state regulation of the information flow.

The introduction of AI algorithms in international coaction contributes to its unification. On the one hand, this leads to a neglect of the individual cultural characteristics of the communicants, and on the other – reinforces cultural stereotypes about each other. This is fraught with creation of a biased attitude towards the culture of the interlocutor and misprediction of the results of interaction (up to the rupture of relations or armed conflict).

The acceleration of response and the lack of need for thorough preparation for the act of intercultural interaction entail a reduction in emotional involvement. Potential interlocutors may lose attention and respect for each other's cultural identity. This tendency is contrary to the very communicative code, whose origins are rooted not just in the exchange of information but also in building long-term relationships of trust between communicants (Shaigorodsky, 2001).

The automated assessment system in language teaching and candidate search in international HR completely sifts off the requests of non-standard thinking students and candidates, rejecting creative human potential and locking the system on itself (Green, 2024).

Eventually, the delegation of analytical and communicative functions to artificial intelligence reduces the ability of specialists in their fields of expertise, makes them unprepared for work offline and creates preconditions for a subsequent shortage of personnel.

Therefore, it is possible to speak of AI as a serious support for work in the field of cross-cultural communication, which is not able, however, at this stage of its development safely and effectively meet all its needs (Lakhani, 2023).

Thus, not being an intellect in the proper sense, but only an imitator of the human's mental processes (analysis, reasoning, speech and creativity), AI is not able to solve fundamentally new tasks of cross-cultural communication (CCC), but only makes calculations and translates some language units into others. AI technologies are not sufficient for the correct translation of complex authorial texts with unique (occasional) or regional lexicon. In the contrary to the communication specialist, it is not capable of empathy «here and now» and self-change strategy of communicative behavior in accordance with changing environment and in relation to ethnic specifics of the interlocutor; it cannot «read between the lines», capturing the hidden meanings and motives of communicants. Being useful in assessing the resource base of conflicting parties, it cannot, however, take into account the irrational behavior of opponents, the effect of the appearance of “black swans”, and reliably predict the results of the conflict. Due to the fundamental inconsistency of intercultural communication to simple exchange of information, it is not able to meet the main need of communicants – deep understanding on the basis of compassion, matching reaction with personal experience of the interlocutor.

In general, in the modern political and economic environment it is necessary to note the need for cross-cultural communication not just in artificial “intelligence”, but precisely in “thinking”, which exceeds the capacity of a biological man – with all its autonomy, flexibility, speed, and imagination, enhanced by the analytical and critical nature of artificial systems. And until this task is accomplished, the cross-cultural specialists should delegate the automatable aspects of CCC to artificial intelligence and focus on deepening their own knowledge in natural languages, culturology, history, conflict studies, and psychology of multinational groups.

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**Stefantsiv A. V.**

## **ARTIFICIAL INTELLIGENCE**

*Language Advisor – CandSc (Education), Assoc. Prof. Borzenko O. P.*

Generative artificial intelligence systems like ChatGPT and Gemini create text, images, audio, video, and other content. This report with questions and answers takes a closer look at the technology behind these increasingly popular systems and their many uses. Systems are trained to recognize patterns and relationships in massive data sets and can quickly generate content from the data at the user's request. These growing capabilities can be used in healthcare, education, software development, business, and other fields. But they can also potentially spread disinformation, displace workers, and pose a threat to national security and environmental (GAO, 2024).

Generative AI can create content such as text, images, audio, or video when requested by a user. Generative artificial intelligence differs from other artificial

intelligence systems in its ability to generate new content, the huge volumes of data required for training, and in the larger size and complexity of its models. A few other notable differences from generative artificial intelligence models include: the use of natural language for hints and the increased challenge in understanding and explaining model decisions. Generative artificial intelligence systems use several architectural models or basic structures. These systems, called neural networks, are modeled after the human brain and recognize patterns in data.

A convergence of factors has enabled the rapid development of generative AI: the availability of large datasets, the improvement and expansion of deep learning algorithms, and computing capacity. Training generative artificial intelligence models requires large amounts of data, much of which are commonly obtained from publicly available information on the Internet and may include copyrighted content. To provide more meaningful and purposeful responses, commercial developers typically use a process called reinforcement learning from human feedback. In this process, generative artificial intelligence models undergo further training, where humans evaluate and rank the results, and then the models imitate human preferences. Processing the training data and adjusting the increasingly large models require corresponding computing capacity. Training large generative artificial intelligence models can take tens of thousands of processors for months and can cost several hundred million dollars.

Commercial developers have created a wide range of generative artificial intelligence models that create text, code, images, and video, as well as products and services that enhance existing products or support custom development and improvement of models to meet customer needs. However, their benefits and risks are still unclear for many applications.

For this technology assessment, GAO was asked to describe generative AI and key aspects of its development. This report represents the first part of the work devoted to generative AI. In future reports, GAO plans to evaluate best practices and other factors considered in the development and implementation of generative

AI tools, the societal and environmental implications of generative AI, and the federal development and implementation of generative AI technologies.

Artificial intelligence systems are already having a significant impact on our lives – they are increasingly forming what we see, believe, and do. Based on the continuous progress in artificial intelligence technology and the significant recent increase in investment, we should expect artificial intelligence technology to become even more powerful and influential in the coming years (Our World in Data, 2024).

It's easy to underestimate how much the world can change in a lifetime, so it's worth taking seriously what those working on AI expect from the future. Many artificial intelligence experts believe that there is a real possibility that human-level artificial intelligence will be developed within the next few decades, and some believe that it will happen much sooner.

A technology that has a huge impact should be of main interest to people throughout our society. But for now, the question of how this technology will be developed and used remains for a small group of entrepreneurs and engineers.

AI has the potential to solve complex problems, from improving education and healthcare to stimulating scientific innovation and combating climate change. However, artificial intelligence systems also pose risks to human privacy, safety, security and autonomy. Effective governance is essential to ensure that the development and deployment of artificial intelligence is safe, secure and reliable, and that policies and regulations promote innovation and competition (OECD, 2024).

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**Suprun V. M.**  
**GAMIFICATION: THE IMPACT OF GAMES ON MODERN IT SOLUTIONS**

*Language Advisor – CandSc (Education), Assoc. Prof. Borzenko O. P.*

In modern technological world, gamification has become an innovative approach to engaging users and solving complex problems. Integrating game mechanics such as rewards, challenges and competitions into non-gaming environments allows IT companies to create unique solutions that increase user efficiency and satisfaction. This approach is widely used in areas such as education, healthcare, marketing and corporate training.

Gamification is based on the basic principles of human motivation. People naturally desire achievement, recognition, and interaction. These factors are effectively applied in gamified systems by:

- Users receive badges, points, or other rewards for completing tasks, which motivates them to take further action.
- Progress scales or performance indicators create a sense of control and motivate you to move to the next level.
- Leader tables and team challenges develop a sense of community and healthy competition.
- Adapting tasks to the needs of a specific user increases engagement and interest.

Gamification is significantly transforming learning processes. Platforms like Duolingo and Khan Academy integrate game mechanics, making learning fun,



interactive, and effective. For example, Duolingo uses daily series, levels, and rewards to encourage regular language practice. Studies show that students using gamified educational platforms have higher retention rates than those using traditional methods.

IT companies are increasingly implementing gamification to improve employee skills and optimize the onboarding process for newcomers. For example, platforms such as TalentLMS allow organizations to create simulations where employees can practice real-world scenarios without risk. In cybersecurity, gamified exercises help employees recognize phishing attacks. These tools make training faster and more effective.

In healthcare, gamification helps engage patients and promote healthy lifestyles. Fitness trackers such as Fitbit or apps such as MyFitnessPal motivate users by challenges, goals, and rewards. More complex apps, such as gamified therapy for chronic disease patients, help patients adhere to their treatment plans.

In IT product development, gamification is used to improve teamwork and optimize project management. For example, tools like Jira include gamified tracking elements that encourage teams to meet deadlines. Developers also use gamified platforms such as HackerRank to improve their skills by interactive coding challenges.

IT companies use gamification to find and evaluate talent. For example, Google uses gamified tasks in its hiring processes, asking candidates to solve interactive coding tasks. This not only effectively evaluates candidates' abilities, but also makes the process interesting.

The main advantages of gamification in IT:

- interactive gamified solutions stimulate users to long-term activity;
- employees undergoing gamified training better absorb information, which has a positive impact on their efficiency;

- IT products with gamified interfaces have a higher level of user retention;
- gamification helps generate new ideas through creative challenges and innovative approaches;
- data collected through gamified platforms allows businesses to better understand user behavior and improve their strategies.

Despite its benefits, gamification has its challenges:

- over time, users may lose interest if game elements become predictable or repetitive;
- gamified platforms collect large amounts of data, which creates privacy risks;
- developing high-quality gamified solutions requires significant resources;
- over-dependence on external rewards can reduce users' intrinsic motivation.

The future of gamification is linked to the integration of latest technologies such as artificial intelligence (AI), augmented reality (AR), and virtual reality (VR). AI enables the creation of personalized interaction scenarios, while VR and AR add immersive elements that improve learning and productivity. For example, VR simulations are already being used to train surgeons, and AR is changing the shopping experience by gamified applications.

Gamification is not just a trend, but a powerful tool that impacts various industries. By understanding human psychology and implementing the latest technologies, it opens up new horizons for improving learning, working, and interacting with technologies.

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**Synkovskyi M.I.**  
**ARTIFICIAL INTELLIGENCE IN ROAD CONSTRUCTION**  
*Language Advisor – Senior Lecturer Ivanova I.L.*

Artificial Intelligence (AI) is revolutionizing various industries, and road construction is no exception. The integration of AI technologies is transforming how roads are designed, built, and maintained, leading to improved efficiency, cost savings, and enhanced safety. This report outlines the key applications of AI in road construction, its benefits, and how it is shaping the future of the industry.

#### AI in Road Design

AI-driven systems have the capability to process vast datasets that include terrain information, weather conditions, traffic patterns, and environmental constraints. By utilizing these data points, AI can propose optimized road designs that take into account both immediate needs and long-term planning (Regona, 2024). These AI systems can simulate different design possibilities, evaluate their impacts, and select the most cost-effective and environmentally friendly options.

For example, machine learning models can analyze historical data on soil stability and suggest design adjustments for safer and more durable roads in specific terrains. This approach helps to reduce both initial construction costs and future maintenance requirements. Moreover, AI can facilitate the planning of roads that minimize environmental impact by choosing routes that avoid ecologically sensitive areas, further promoting sustainability in infrastructure projects.

In addition, AI can be used to enhance urban and rural connectivity by identifying areas where road networks can be improved (Akinosho, 2020), leading to more efficient traffic flow and reduced travel time. These AI-driven designs can also help alleviate congestion in rapidly growing cities, ensuring road networks are scalable for future needs.

#### Automation in Construction Processes

Automation is a critical area where AI is making significant strides. AI-powered machinery can now perform repetitive and labor-intensive tasks with

higher precision and efficiency than human operators. For example, autonomous bulldozers, pavers, and rollers are equipped with sensors and AI control systems that allow them to perform grading, leveling, and paving tasks with remarkable accuracy. These machines can operate 24/7 with minimal supervision, which helps in completing projects faster and with fewer errors.

Drones are another AI-driven tool that is increasingly being used in road construction. These drones are equipped with advanced cameras and sensors, allowing them to conduct aerial surveys of construction sites, monitor progress, and collect real-time data on the condition of the terrain. By analyzing this data, AI can generate detailed 3D maps of the site and identify potential issues before they become problematic, such as identifying weak spots in the soil or areas that may be prone to erosion.

Furthermore, AI-powered robots are used to lay road materials more efficiently and with greater precision. These robots can analyze data from sensors to ensure that the materials are laid evenly and correctly, reducing the chances of defects in the road surface. By reducing the reliance on manual labor, AI-driven automation improves the overall safety of construction sites by minimizing the risk of human error and accidents.

### Quality Control and Monitoring

AI systems integrated into road construction processes offer unprecedented levels of quality control. By utilizing AI-equipped sensors, cameras, and other monitoring technologies, road construction teams can continuously track the quality of materials being used and the processes being applied (Rao, 2022). AI systems can analyze construction data in real time and detect deviations from design specifications or construction standards. For instance, AI can monitor the temperature and composition of asphalt during paving, ensuring that it is applied under optimal conditions to maximize durability and safety.

AI is also capable of detecting defects in road surfaces that may not be visible to the naked eye, such as micro-cracks or surface irregularities. Through

machine vision technology, AI can instantly flag any issues and recommend corrective actions, such as re-compacting or applying additional materials. By catching defects early in the construction process, AI can prevent costly repairs and reduce the likelihood of road failures, such as potholes or surface cracks, which can occur later on.

Additionally, AI systems can be integrated with predictive analytics to forecast potential problems based on data collected during construction. This allows engineers to take preemptive measures to mitigate risks, ultimately resulting in roads that have a longer lifespan and require less frequent maintenance.

#### Predictive Maintenance and Road Wear Forecasting

AI has the potential to revolutionize the way road maintenance is conducted through predictive maintenance models. Traditional road maintenance is often reactive, addressing issues only after they arise. However, AI allows for a more proactive approach by predicting road wear and identifying areas that are likely to deteriorate based on various factors such as traffic load, weather conditions, and material properties (Karimzadeh, 2020).

By analyzing historical and real-time data, AI algorithms can assess the rate of road degradation and predict when and where maintenance will be required. This enables road authorities to schedule maintenance activities in advance, reducing the need for emergency repairs and minimizing disruptions to traffic. Predictive maintenance also ensures that road surfaces remain in good condition for a longer period, improving safety for drivers and reducing long-term repair costs.

For example, sensors embedded in the road can monitor vibrations, traffic loads, and weather exposure. The AI system analyzes this data and identifies sections of the road that may be at risk of cracking or potholing (Karimzadeh, 2020). This data-driven approach allows road operators to plan targeted maintenance, ensuring that resources are allocated efficiently.

#### Smart Roads and Traffic Management

Smart roads represent the next step in the evolution of road infrastructure, with AI at the core of their development (Karimzadeh, 2020). Smart roads are equipped with advanced sensors and AI systems that collect data on traffic conditions, weather, and road performance. This data is used to optimize traffic management, reduce congestion, and improve road safety.

For instance, AI can analyze traffic flow in real time and adjust traffic lights to optimize the flow of vehicles through intersections. This reduces the risk of accidents and minimizes delays during peak traffic hours. AI systems can also monitor driver behavior, identifying reckless driving, speeding, or drowsy driving, and alerting authorities or autonomous vehicles to intervene when necessary.

In the context of autonomous vehicles, smart roads play a crucial role in enabling safer and more efficient transportation. AI systems embedded in the road can communicate with self-driving cars, providing them with information about traffic patterns, road conditions, and potential hazards. This facilitates smoother navigation and enhances the overall safety of the transportation system.

#### Sustainability and Efficiency

Sustainability is becoming a critical consideration in road construction, and AI is helping the industry move towards greener practices. AI systems can recommend sustainable materials and construction techniques that reduce the carbon footprint of road projects. For instance, AI can analyze the lifecycle of different materials, selecting those that require less energy to produce and are more durable, reducing the need for frequent repairs.

AI can also optimize resource usage by ensuring that materials are delivered and used efficiently, minimizing waste. By analyzing construction data, AI can identify areas where resources can be conserved, such as by optimizing the amount of asphalt used in paving or reducing the energy consumption of construction machinery.

In addition to promoting sustainability during construction, AI can help design roads that require less maintenance and fewer resources over time. By

analyzing traffic patterns, AI can recommend designs that are more resilient to heavy traffic loads, reducing the need for frequent repairs and the associated environmental impact.

#### Logistics and Planning

AI also enhances logistics and planning in road construction projects. Effective logistics are critical to ensuring that construction projects stay on schedule and within budget. AI-powered systems can optimize the delivery of materials and equipment, ensuring they arrive at the right time and in the correct quantities [6]. This reduces downtime and minimizes the risk of delays caused by material shortages or equipment failures.

AI can also be used to analyze historical data on construction delays, such as those caused by bad weather, supply chain disruptions, or equipment breakdowns. By identifying potential risks, AI can help construction managers develop contingency plans to minimize delays and ensure the project stays on track.

For example, an AI-driven project management system can analyze weather forecasts and predict how weather conditions may impact construction timelines. It can then adjust the schedule accordingly, ensuring that crews focus on tasks that are not weather-dependent when adverse conditions are expected.

In conclusion, it is important to emphasize that AI is reshaping the road construction industry by making processes more efficient, cost-effective, and safer. From optimizing road design to automating construction equipment, AI offers numerous advantages that improve the quality and longevity of road infrastructure. As AI technology continues to evolve, its impact on road construction is likely to expand, contributing to smarter, more sustainable roads for the future.

Incorporating AI into road construction projects ensures that future infrastructure can meet the demands of growing populations and increasingly complex transportation networks while remaining efficient and environmentally friendly. The continued development and application of AI in road construction



have the potential to revolutionize the industry, leading to safer, more resilient, and more sustainable infrastructure.

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**Tarasov Ye. M.**

**ARTIFICIAL INTELLIGENCE: APPLICATION IN THE FUTURE  
PROFESSION AND DEVELOPMENT PROSPECTS**

*Language Advisor – CandSc (Education), Assoc. Prof. Borzenko O. P.*

Artificial intelligence (AI) is rapidly evolving and changing the professional landscape in different industries. Its ability to process large volumes of data,

perform complex analysis, and automate routine tasks makes AI a cornerstone of modern technological progress. This article examines how AI can be applied in the future profession, what challenges and opportunities it creates, and its potential impact on future professional activities.

Integrating AI into professional activities opens up new opportunities for increased efficiency and innovation. In healthcare, AI-based systems enable early diagnosis and personalized treatment by analyzing patient data and identifying patterns that often go unnoticed by doctors. For example, computer vision algorithms can accurately detect pathologies in X-rays or MRIs, which speeds up and improves diagnostic accuracy (Коротка & Мокринський, 2024).

In finance, AI is revolutionizing asset management by creating predictive models to analyze market trends, helping professionals make informed decisions. Machine learning algorithms are also improving fraud detection by identifying unusual transactions and protecting users and institutions from potential risks (Pylypenko, Hubar, & Chyrva, 2023).

In education, AI-based platforms personalize the learning process by adapting to individual student needs. These systems analyze performance data to recommend relevant materials, ensuring effective knowledge acquisition (Мурадов, 2024). Similarly, in marketing, AI helps optimize campaigns by predictive analytics, allowing companies to understand consumer behavior and improve customer engagement (Khemis, 2020).

With the development of technology, the role of AI in professional activities will expand significantly. One of the promising areas is the creation of universal AI systems capable of performing many tasks in different fields. Unlike highly specialized AI, such AI is aimed at performing complex functions similar to human thinking (Коротка & Мокринський, 2024).

In addition, advances in natural language processing (NLP) technologies will enable machines to understand and generate human language even better. This will

facilitate more effective interactions between specialists and AI systems in the fields of law, journalism, and customer service (Шадська et al., 2024).

AI-driven robotics will transform fields such as manufacturing and logistics. Autonomous robots will simplify manufacturing processes and supply chain management, reducing costs and increasing productivity. In agriculture, AI-based drones and sensors optimize crop management by providing real-time data on soil condition and pest control (Шадська et al., 2024).

Despite its many benefits, integrating AI into professional activities poses several challenges. One of the main problems is the ethical aspects of using AI. Biases in algorithmic decisions can lead to unfair results, particularly in areas of hiring, lending, or law enforcement (Мурадов, 2024).

Data security is another critical aspect. Since AI systems often process confidential information, it is necessary to ensure strong cybersecurity actions to prevent data leakage and misuse (Khemis, 2020).

In addition, the high cost of developing and implementing AI technologies may become a barrier for small businesses and resource-dependent sectors. To solve this problem, innovative solutions are needed that will make AI more accessible (Khemis, 2020).

The AI social impact also requires attention. Automation could replace certain jobs, leading to unemployment and economic inequality. Governments and organizations should implement retraining and training programs to ensure a smooth transition to the new conditions (Шадська et al., 2024).

The future of AI in the professional activity looks promising. As more organizations use AI-based solutions, the demand for skilled specialists who can develop, manage, and interpret these systems will increase. Fields such as data science, AI ethics, and human-AI interaction design will become critical to ensuring the effectiveness and fairness of technologies (Шадська et al., 2024).

Collaboration between AI and humans will evolve, with AI performing repetitive and labor-intensive tasks and humans focusing on strategic decision-

making and creative aspects. For example, AI can help architects generate design options based on environmental data, allowing specialists to focus on aesthetic and functional aspects (Шадська et al., 2024).

Artificial intelligence is changing the professional landscape, offering unprecedented opportunities for increased efficiency, innovation, and growth. While challenges exist in the areas of ethics, accessibility, and social impact, the potential benefits far outweigh the disadvantages. Solving these challenges and facilitating collaboration between humans and AI will allow for the most effective use of this transformative technological tool. With AI development, its integration into professional activities will not only change working ways, but will also open up new opportunities for human achievement.

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**Tolkachov M. S.**

## **OPPORTUNITIES AND CHALLENGES IN A DIGITAL WORLD**

*Language Advisor – Senior Lecturer Ivanova I.L.*

The rapid development of information technologies (IT) has transformed various aspects of modern life, from communication and education to business and healthcare. These advancements have introduced innovative solutions that improve efficiency, accessibility, and productivity across multiple industries.

One of the key areas where IT has made a significant impact is communication. The introduction of high-speed internet, social media platforms, and instant messaging applications has revolutionized how people connect with each other. Platforms like Zoom and Microsoft Teams have become indispensable for remote work and virtual meetings, especially during the COVID-19 pandemic.

Moreover, cloud-based solutions enable seamless collaboration regardless of geographical location.

In education, IT has opened new horizons for both students and educators. E-learning platforms, such as Coursera and Khan Academy, provide access to high-quality educational materials from anywhere in the world. Virtual classrooms and online courses have made learning more flexible and inclusive. Students can now pursue degrees or certifications at their own pace, which has significantly democratized education. Additionally, the use of augmented and virtual reality tools enhances interactive learning experiences, making education more engaging.

The healthcare industry has also benefited immensely from IT advancements. Electronic health records (EHRs) and telemedicine services have improved patient care and accessibility. IT tools assist doctors in diagnosing diseases through AI-driven applications, while wearable devices, such as fitness trackers, enable individuals to monitor their health in real time. Furthermore, advancements in biotechnology, supported by IT, facilitate groundbreaking research in personalized medicine and genomics.

In the business sector, IT drives innovation and efficiency. Automation tools and enterprise resource planning (ERP) systems streamline operations and reduce costs. E-commerce platforms like Amazon and eBay have transformed traditional retail, offering convenience and a broader market reach. Furthermore, data analytics and AI-powered algorithms allow companies to gain insights into customer behavior and market trends, fostering better decision-making processes.

The entertainment industry has also experienced a significant transformation due to IT advancements. Streaming services such as Netflix and Spotify have revolutionized how people consume media, offering instant access to vast libraries of movies, music, and TV shows. Video game development has embraced cutting-edge technologies like virtual reality (VR) and augmented reality (AR), creating immersive experiences for players worldwide. These innovations have not only

enhanced user engagement but have also opened up new revenue streams for creators.

Another crucial aspect of IT is its role in environmental sustainability. Smart technologies are being used to monitor and manage resources more efficiently. For instance, smart grids optimize electricity distribution, while IoT devices help reduce energy consumption in homes and offices. IT also supports climate research by enabling advanced data analysis and modeling, which helps scientists better understand and address global environmental challenges.

The transportation sector has also seen a significant impact from IT advancements. Technologies such as GPS, ride-sharing apps, and autonomous vehicles have revolutionized how people and goods move from one place to another. Smart traffic management systems use real-time data to reduce congestion and improve urban mobility, while IT-enabled logistics solutions have streamlined supply chains, making them more efficient and cost-effective.

Cybersecurity is a vital domain profoundly influenced by IT. As digitalization grows, so do the risks associated with cyber threats. Organizations invest heavily in cybersecurity solutions to protect sensitive data and systems.

Innovations in encryption, biometrics, and AI-driven threat detection tools are paving the way for more secure digital ecosystems. However, the ever-evolving nature of cyber threats underscores the need for ongoing vigilance and innovation in this field.

IT also plays a pivotal role in advancing scientific research. High-performance computing, data analysis, and simulation tools have accelerated discoveries in fields such as physics, chemistry, and biology. For instance, IT-enabled modeling helped researchers develop vaccines for COVID-19 in record time. By processing vast amounts of data quickly and accurately, IT has become an indispensable tool for modern scientists.

Despite these advancements, the challenges posed by IT cannot be ignored. Issues such as cybersecurity threats, digital addiction, and the ethical use of AI

require immediate attention. The development of global standards and regulations is essential to ensure that technological progress aligns with societal values.

Moving forward, addressing these challenges while harnessing the potential of IT is essential. Governments and organizations must invest in cybersecurity measures and promote digital literacy. Educational institutions should focus on teaching critical thinking skills to enable individuals to navigate the vast information landscape responsibly. These efforts can help ensure that the benefits of IT are distributed equitably, fostering a more inclusive and sustainable future.

In conclusion, the rapid evolution of information technologies has reshaped virtually every aspect of modern life, offering transformative benefits across communication, education, healthcare, business, entertainment, and beyond. These advancements have enhanced accessibility, efficiency, and innovation, driving progress and improving quality of life for many. However, the challenges accompanying these developments, such as cybersecurity risks, ethical dilemmas, and the digital divide, cannot be overlooked.

To fully realize the potential of IT while addressing its pitfalls, a collaborative approach involving governments, organizations, educational institutions, and individuals is vital. Investments in robust cybersecurity measures, efforts to promote digital literacy, and a commitment to ethical technology development are crucial steps toward a balanced technological future. By addressing these challenges thoughtfully and equitably, IT can continue to be a driving force for progress, fostering a world that is not only more connected but also more inclusive, sustainable, and resilient.

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**Tovstoluh D. V.**

**THE ROLE OF BLOCKCHAIN TECHNOLOGY IN FORMING THE  
ECONOMY OF THE FUTURE**

*Language Advisor – CandSc (Education), Assoc. Prof. Borzenko O. P.*

The development of blockchain technology has brought about significant shifts in various fields, becoming a fundamental element for the global economy of the future. Its impact extends beyond cryptocurrency to sectors such as finance, healthcare, logistics, and more. By solving problems like inefficiency, fraud, and lack of transparency, blockchain is ready to transform economic systems around the world.

Blockchain technology acts as a decentralized, immutable registry that promotes trust and transparency. Tapscott emphasizes that its fundamental strength lies in solving the “double-spending problem” by providing unique, secure transactions without the need for intermediaries (Tapscott, 2016). This innovation can disrupt traditional financial services by rethinking how value is transferred, stored, and managed.

In global markets, blockchain makes it easier to implement cross-border transactions with reduced costs and settlement times. Smart contracts, self-executing transactions encoded on blockchain, additionally automate business operations, reducing administrative costs and increasing reliability.

Blockchain can be applied in various sectors such as finance, logistics, and healthcare (Levis et al., 2021).

In finance and banking, blockchain is reimagining traditional banking, enabling digital currencies, decentralized finance (DeFi), and borderless payments. Integrating blockchain into banking systems reduces the risk of fraud, speeds up settlement processes and reduces operating costs.

In supply chain management, blockchain improves supply chain transparency by recording every transaction in an immutable registry. This helps track the origin of goods, ensure ethical deliveries, and improve inventory management (Weston, 2024).

In healthcare, blockchain has potential applications in securing medical records, streamlining medical billing, and tracking pharmaceuticals. Its ability to store and protect confidential data while ensuring accessibility is vital to combating fraud and improving patient care.

In the intellectual property and creative industries, technology allows artists and creators to directly monetize their work. These could be blockchain platforms where musicians retain ownership of their intellectual property and receive fair compensation.

The decentralized nature of blockchain democratizes economic systems, allowing individuals and small businesses to participate in global markets. Decentralized applications (dApps) and tokenized assets create new opportunities for fundraising, investment, and entrepreneurship. Research in PLOS ONE highlights the role of blockchain in promoting financial inclusion by providing the unbanked population with access to digital financial services (Levis et al., 2021).

Blockchain also supports sustainable development by enabling the trading of carbon credits and improving energy management systems through decentralized networks.

Despite its promise, blockchain implementation faces obstacles such as high energy consumption, scalability problems, and regulatory uncertainty. Tapscott

emphasizes the importance of governance in forming the trajectory of blockchain development, as a lack of control can lead to abuse and chaos (Tapscott, 2016).

However, the advancement of blockchain protocols and wider adoption by governments and enterprises signals a promising future. It is expected that the technology will form the basis of Web3 innovations, reimagining the Internet as a decentralized space.

Blockchain technology has the transformative potential to reshape the global economy promoting trust, efficiency and inclusivity. Its application in various fields paves the way for a more just and transparent future. As the problems are solved, blockchain could become the core pillar of the economy of the future, providing capabilities to individuals and businesses.

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**Volobuieva V. S.**  
**POTENTIAL BENEFITS AND DANGERS OF ARTIFICIAL  
INTELLIGENCE**

*Scientific Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*  
*Language Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*

Artificial intelligence (AI) plays a key role in the modern world, affecting various areas of life: from economics to science, medicine and everyday life. Thanks to the rapid development of technology, AI is increasingly integrated into everyday processes, simplifying and optimizing many tasks. It plays an important role in the economy and business, where AI is used to automate processes, analyse big data, predict market trends, and improve customer service (for example, through chatbots). This allows businesses to increase efficiency and reduce costs; in healthcare, where AI helps diagnose diseases, process medical data, and develop individualised treatment approaches. Machine learning can detect pathologies at early stages, which increases the chances of recovery; in science and technology, where AI is used to model complex systems, such as climate change or molecular structures. This accelerates scientific discoveries and helps solve global problems such as climate change or the development of new materials; in transport and logistics, as autonomous vehicles and AI-based supply chain management systems improve road safety and reduce transportation costs; in education and culture, where AI is used in educational institutions to personalize the learning process, and in culture to create new art forms, such as generative algorithms for music or images.

Nowadays, AI not only makes our lives easier, but also opens up new opportunities for the development of society, the economy and science. However, this also raises ethical questions about the use of AI, including privacy, data security, and the role of humans in a world where many processes are automated.

Artificial intelligence has many advantages, making it a valuable tool in the modern world. This includes automating routine tasks, as AI can perform everyday, routine, or monotonous tasks without human intervention. This reduces the risk of

human error, increases work efficiency, and frees up time for more complex tasks. For example, automation of production processes or customer service through chatbots is big data processing. AI can analyze huge amounts of data at incredible speed, identify hidden patterns, make predictions, and make decisions based on this data. This is extremely useful in finance, marketing, science, and many other industries; it improves accuracy and performance, as machine learning and neural networks can learn from examples and improve their predictions over time, which increases the accuracy of the results; it is availability, where AI systems can work 24/7 without fatigue. This is particularly useful in areas such as customer service or infrastructure management, where continuous operation is important to meet user needs; it is the personalization of services, as AI allows for personalized user recommendations and experiences. This is used in e-commerce, media platforms, marketing, and education. For example, video or music streaming platforms use AI to offer content based on users' interests; security and monitoring, where AI helps in face recognition, analyzing surveillance video, and cybersecurity by identifying potential threats and preventing cyberattacks; and the development of science and research, as AI significantly accelerates scientific discoveries by modeling complex processes, analyzing large amounts of data, and helping to find new ways to solve problems in medicine, ecology, and other areas (Термапк, 2017).

Thanks to these benefits, AI is driving progress in various industries, making people's lives more convenient and helping to solve complex problems that previously seemed impossible.

Despite its many advantages, artificial intelligence also has certain disadvantages that cause concern in society. The main disadvantages of AI include 1) data dependency, where AI requires large amounts of data to learn and function. If the data is inaccurate or biased, the results of AI may be unreliable or discriminatory. For example, facial recognition algorithms may show less accuracy for members of certain ethnic groups due to uneven data distribution; 2) job losses, as automation of AI processes may lead to job losses, especially in industries

dominated by routine tasks, such as manufacturing or service. This raises fears of mass unemployment and the need to retrain workers for new professions; 3) data privacy and security, where AI processes huge amounts of personal data, which increases the risk of privacy breaches and cyberattacks. If the data is hacked or misused, it can significantly violate people's privacy; 4) ethical issues and biases, as AI can make decisions that do not always comply with ethical standards. For example, algorithms used in the judicial system may reinforce racial or social biases if they are trained on data with such issues. This raises questions about the fairness of automated decisions; 5) lack of transparency and explanation, where many modern AI algorithms, especially those based on deep learning, are 'black boxes', meaning that even developers cannot always explain how AI came to a certain decision. This makes it difficult to control the correctness and fairness of its work; 6) dependence on technology, where excessive reliance on AI can lead to a loss of skills and competencies among people. If people rely on AI for decision-making in all areas of life, it may reduce their ability to think critically and make decisions independently; 7) impact on social interaction, where automated systems may reduce the amount of direct interaction between people. For example, in retail or customer service, replacing humans with chatbots or automated systems may reduce empathy and personal touch; 8) security threats, where the use of AI in autonomous military systems or cybercrime poses risks to global security. AI can be used to create sophisticated cyber-attacks or to develop autonomous weapons that can get out of control.

Thus, despite its capabilities, AI needs to be carefully regulated and controlled to prevent negative consequences of its implementation.

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**Zadorozhna A.O.**

**ARTIFICIAL INTELLIGENCE IN THE MODERN WORLD**

*Scientific Advisor – Candidate of Philological Sciences, Assoc. Prof. Yazlovytska  
O.V.*

*Language Advisor – Candidate of Philological Sciences, Assoc. Prof. Yazlovytska  
O.V.*

Artificial intelligence is a branch of computer science and technology that develops various algorithms and systems that in the modern world can mimic human intelligence or even better it. These systems can be taught to do anything. Artificial intelligence can solve many complex and illogical tasks better than human experts in a very short period of time. The development of AI is very rapid nowadays. Every year, something unexpected and unusual appears.

The first success on the way to development was brought by Turing's invention in 1936. It was a machine that performed mental processes, could calculate and execute simple algorithms.

The notion of artificial intelligence emerged in 1940 under the name of the Artificial Brain Machine. But the first programme was not successful and popular. In 1956, the term 'Artificial Intelligence' was coined at a conference in Dartmouth by American computer scientist John McCarthy. Subsequently, this industry developed more and more, with many ups and downs.

Already in 1980, the first national conference was held at Stanford University and professional programmes appeared to solve problems. However, artificial intelligence started gaining popularity in 2010 at the time of a breakthrough in computer technology.

In modern times, AI has begun to develop rapidly and achieve significant success in various areas of human activity. For example, it helps to translate text into different languages, solve problems, and make online purchases. But it raises many questions about security. Because these apps contain a lot of different personal information that no one should know except for the device and you. Therefore, it is very important to protect the information well in order to introduce

artificial intelligence into everyday life. Artificial intelligence can also pose a threat such as unemployment, which can lead to an economic crisis.

Nowadays, the most famous invention is ChatGPT, which appeared in 2022. You can communicate a lot with the chat and it will answer any of your questions and help you solve any problem not only with your studies, but also with various problems that may occur in life. Many people talk to it as if it were their friend, asking it something personal and expecting it to support them (Литвин, 2009).

AI is making great strides in medicine, economics, transport, art, and education. In online shopping, AI is used to advertise products, and AI can also detect fraudsters on the Internet.

Artificial intelligence is widely used in medicine. Doctors can use it to quickly determine a patient's diagnosis and prescribe a treatment plan.

Also, a lot of modern transport, especially cars, is now appearing. Artificial intelligence plays a crucial role in them, taking care of passengers and helping to avoid dangerous situations on the roads, recognising objects, obstacles, road signs, and when drivers ignore the rules. Algorithms can manage parking, driver behaviour, and monitor the entire journey.

In education, AI helps to develop a better curriculum. An individual approach to each student will improve their desire to learn. If the programme is developed with high quality, people will be interested in learning and will be motivated for the future.

AI is also used for games. There are many computer games that are very similar to real life. Different characters are created using artificial intelligence. There is also virtual reality, where a person puts on glasses and plunges into reality, but sees the game of his or her choice. The game is made very realistically and sometimes you even think that you are really there.

So, artificial intelligence has great advantages: time saving, medicine, security, labour and modern inventions.



Artificial intelligence is making our world a better and more modern place. It helps people to work less and does everything for them. But in the future, this can lead to problems. People won't feel emotions, won't do anything, and won't work at all.

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**Zarytskyi O. V.**

### **USE OF AR TECHNOLOGIES IN THE URBAN ENVIRONMENT**

*Language Advisor – Senior Lecturer Ryabovol G. S.*

Many more industries and sectors will learn about the possibilities of GIS technology and how valuable geospatial data is. With better and more powerful computers, the quality of these systems has improved rapidly. The merge of virtual reality and GIS, and other advanced techniques has created new possibilities for visualizing and analyzing spatial data in urban management and many other fields. Geospatial AR (Augmented Reality) technology combines real-world spatial data with computer-generated models to enhance the user's perception of their surroundings by using GNSS to position and align virtual models precisely, attribute information in smartphone or AR headset, where users see virtual directions overlaid on actual streets. Such an approach can be helpful for spatial awareness and decision-making in tourism, urban planning, navigation, military, architecture, entertainment, and more.

AR technology can be used for inter-city navigation; navigating through highlighted directions on what the mobile phone camera sees, along with instruction points for easy readability is possible. Most map services like Google Maps offer AR walking directions, where users can see arrows and markers

overlaid on their real-world view through their smartphones (Lee & Sun, 2024). The feature proves crucial in dense urban areas, simplifying navigation and excludes the possibility of disorientation. The technology is not restricted to a single application and can be applied in various other areas. For example, modern vehicles now feature head-up displays (HUDs) that project navigation data directly onto the windshield. It allows drivers to access turn directions, speed limits, and alerts without diverting their attention from the road.

Underground utilities remain hidden beneath the surface, unseen and quickly forgotten – until an accident occurs. Damaging underground infrastructure during excavation can lead to severe consequences. The solution lies in visualizing what cannot be seen. AR technologies can align virtual underground data with the real-world aboveground environment, helping to prevent accidental utility strikes during excavation and enhancing maintenance efficiency. The system integrates technologies in the fields of AR and 3D GIS. It aims at offering an AR assistive system to help utility field workers to visualize the buried infrastructures on a smartphone or a tablet (Xu & Moreu, 2021b), providing a real-time and high-accuracy visualization of surrounding underground utilities (water, gas, sewerage, electricity, etc.). As the system is designed to maintain buried utilities, it should provide localization accuracy. It is achieved by using Real Time Kinematic (RTK) satellite navigation. AR provides accurate and stable on-site visualization of underground pipes, cables, and other utilities, resembling an X-ray view. It raises situational awareness, enabling field crews to complete routine tasks more efficiently and effectively, thereby boosting productivity. Improved awareness also helps prevent accidents by uncovering hidden hazards.

The future of AR in urban environments is marked by its role in smoothly connecting physical and digital spaces, driving efficiency and engagement. Key trends include the integration of generative AI, which enhances the creation of digital environments with lifelike interactions, multi-sensory features like haptics, enriching user experiences in tourism, planning, and public consultations (Future of

Augmented Reality – AR Trends for 2024 – Nsflow, n.d.). Technological advancements, such as LiDAR-enabled tools and motion capture systems, promise precise urban planning and infrastructure management applications. Wearable AR devices, such as smart glasses, are gaining popularity in industries like logistics and construction for hands-free operations. The developments position AR as essential for smart cities, enabling real-time visualization, interactive public spaces, and streamlined urban processes.

On the other hand, the adoption of AR in urban environments is restricted by several challenges and limitations (AR For Navigation – What You Should Know in 2023 – BairesDev, 2021). One key issue is user acceptance. Many individuals are unfamiliar with AR technology or skeptical about its benefits, which makes public adoption a significant hurdle. It requires extensive marketing, education, and clear demonstrations of AR's tangible advantages to overcome doubts and drive engagement. Cybersecurity concerns also play a critical role. AR applications often rely on location tracking and real-time data collection, which may conflict with privacy laws and require adherence to stringent data protection regulations. Additionally, technical barriers such as ensuring consistent accuracy of AR projections, minimizing hardware limitations like battery life, and maintaining the accessibility of devices further complicate large-scale implementation.

Geospatial AR offers massive potential across diverse sectors, from navigation and urban planning to tourism and entertainment. However, its adoption in urban environments is limited by challenges such as user acceptance, privacy concerns, and technological constraints. Addressing these issues through better privacy frameworks, user education, and ongoing innovation is crucial to unlocking AR's full capabilities in transforming urban landscapes.

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**Zdykhalskyi V. A.**

### **THE ROLE OF DIGITALISATION IN MODERN HR MANAGEMENT**

*Language Advisor – Asst. Prof. Chevychelova O. O.*

The relevance of this topic arises from the fact that, in today's world, the digitalisation of human resources (digital HR) is a critical strategic direction in modern organisational management. It enhances efficiency and productivity, optimises recruitment and development processes, and fosters an innovative and adaptive work environment.

To understand the phenomenon, it is first necessary to define "digital HR." The term combines "digital," referring to the use of digital technologies, and "HR," which stands for human resources. Digital HR is a contemporary approach to managing human resources through digital and modern technologies, significantly

enhancing companies' capacity to organise personnel processes efficiently and conveniently for employees.

While digital HR originally referred to the use of digital technologies specifically, its scope has broadened with the advent of diverse, related innovations. It now encompasses the application of any new technologies within the human resources economy.

The era of digital HR is considered to have begun in the second decade of the 21st century when the concept gained official recognition. Discussions about the 4th Industrial Revolution have further underscored its importance. This revolution, highlighted at recent World Economic Forums, blurs the boundaries between the physical and technological worlds. Innovations such as virtual reality and advanced digital technologies are transforming social and labour relations, paving the way for new methods of interaction and information exchange.

The digital transformation of human resources management plays a dual role. On one side, HR teams must transform internally, incorporating automation and digital processes. On the other, they collaborate with IT departments to drive broader organisational change, shaping employees' digital mindsets, improving human capital, and enhancing productivity. This transformation involves three key dimensions: 1) digital workforce: attracting talent with innovative thinking, addressing the digital skills gap, and ensuring continuous learning through modern technologies; digital workplace: creating environments that boost productivity, facilitate communication, and provide feedback; 3) digital HR: revolutionising HR functions through cutting-edge tools, technologies, and software.

The digitalisation trend has surged in the past decade. Internet accessibility has reached nearly 99% of individuals aged 12-24, with significant penetration in older demographics. On average, users operate 2-3 digital devices daily, spending over two hours each on desktops and mobile internet. Mobile applications offer unprecedented access, catering to round-the-clock demands. However, HR digitalisation remains in its nascent stages, necessitating further exploration and

definition. The latest trends in the development of HR-Digital, which are predicted to be relevant in the near future, are shown in Figure 1.

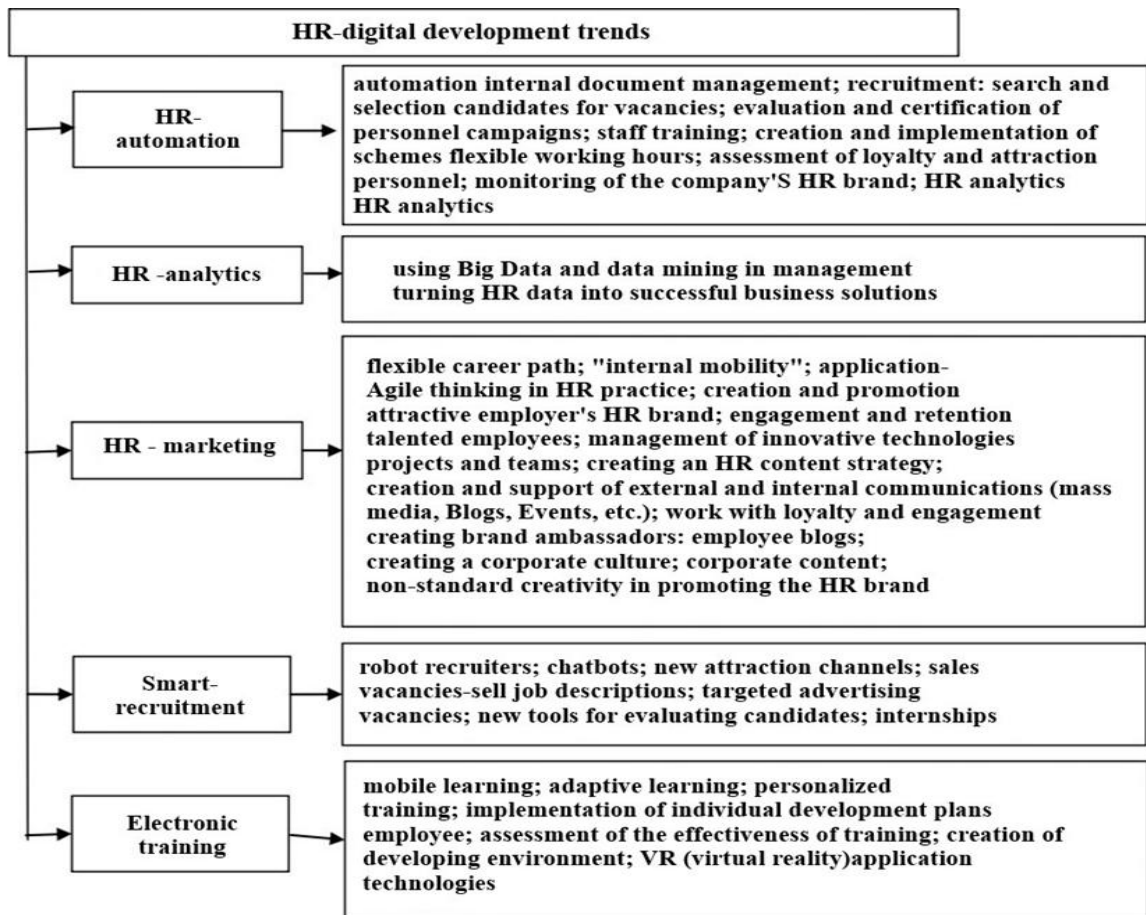


Fig. 1 - The latest trends in HR-Digital development

Despite technological advances, people remain the cornerstone of organisational success. Employers, leaders, and HR managers must prioritise employee support, collaboration, and motivation to build a positive culture and achieve business objectives. Empathy and understanding from managers have proven to significantly enhance productivity and employee retention. Research indicates that employees thrive when their emotional needs are acknowledged, highlighting the importance of empathy-driven leadership.

Skilled and motivated employees are vital for business success. HR managers must craft effective strategies, including individual development plans and digital

solutions. Social media, artificial intelligence, automation, and cloud technologies are increasingly leveraged to streamline HR processes. Future advancements in AI could address critical issues, such as salary inequalities. However, these changes demand high levels of digital competence in HR professionals, particularly in analytics and automation.

Digital transformation also fosters improved communication and collaboration. Tools like electronic communication platforms and internal corporate systems enable efficient information sharing, project coordination, and teamwork. Data analytics further empowers HR managers by providing insights into productivity, employee satisfaction, and other key metrics, paving the way for better management practices and a positive work culture.

Digitalisation plays a transformative role in modern HR management, reshaping traditional practices to align with contemporary organisational needs. By integrating digital tools and technologies, HR functions are becoming more efficient, adaptable, and innovative. This shift enhances recruitment, optimises employee development, and fosters a collaborative and productive workplace.

The digital era demands a dual focus for HR teams: transforming their internal processes through automation and digital solutions while driving broader organisational change by cultivating a digital mindset among employees. These efforts are critical for improving productivity, bridging skills gaps, and ensuring continuous learning and development.

However, even in an increasingly digital environment, the human element remains central. Empathy, understanding, and personalised approaches by HR managers are essential for building trust, boosting employee engagement, and achieving business objectives. As digitalisation evolves, HR professionals must develop advanced competencies in data analytics, automation, and digital strategy to fully leverage emerging opportunities.

Ultimately, digitalisation in HR is not just about adopting new technologies but about creating a synergy between technological innovation and human capital to drive organisational success in a dynamic and competitive landscape.

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**Zemlianoi O. A.**

**APPLICATION OF CLOUD PLATFORMS FOR STORAGE AND  
PROCESSING OF VEHICLE ROUTES DATA: COMPARISON OF AWS,  
AZURE AND GOOGLE CLOUD PLATFORMS FOR ROUTING SYSTEMS  
DEVELOPMENT**

*Language Advisor – CandSc (Education), Assoc. Prof. Borzenko O. P.*

With the development of technology and urbanization, the need for efficient traffic flow management and vehicle routes optimization increases. Cloud platforms, including Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP), are becoming a key tool for optimizing vehicle routes. These technology giants offer unique capabilities for collecting, storing, and analyzing large volumes of information. Particular attention is paid to their



capabilities in the development of transport systems, evaluating key characteristics such as scalability, performance, security and cost.

Modern cities face significant challenges in managing transport systems due to growing urbanization and the increase in the number of vehicles. Effective route planning and optimization are critical to reducing congestion, decreasing emissions, and improving the efficiency of logistics operations. Traditional data processing methods often can't cope with the large volumes of information generated by modern transport systems. In this regard, cloud platforms offer new opportunities for storing, processing and analyzing data in real time (Islam, 2023).

Cloud technologies have changed the approach to software development and deployment, providing the possibility to scale resources according to needs, reduce infrastructure costs, and provide access to powerful computing resources. In the context of vehicle routing systems, cloud platforms provide the scalability to process huge volumes of data generated by sensors, GPS devices and other sources in real time. This is especially important for large cities and regions with heavy traffic. Flexibility allows for the rapid deployment of new services and the updating of existing ones without the need for long system shutdowns. Economic efficiency is achieved through a pay-as-you-go model, which reduces infrastructure and maintenance costs. Security and reliability are ensured by leading cloud platforms offering high levels of data security and system reliability.

Amazon Web Services is one of the most widely used cloud platforms, offering a wide range of services for different needs. In the context of routing systems, AWS offers compute resources through Amazon EC2, data storage through Amazon S3 and Amazon EFS, databases through Amazon RDS and Amazon DynamoDB, and networking services through Amazon Route 53 and Amazon VPC. In addition, AWS has its own service for mapping and geospatial analysis – Amazon Location Service, which provides capabilities for creating maps, routing, and tracking resources. This simplifies the development of routing systems as it does not require the use of third-party solutions (AWS, 2024).

Microsoft Azure is a powerful cloud platform with tight integration with Microsoft products. For routing systems, Azure offers computing resources through Azure Virtual Machines and Azure Functions, data storage through Azure Blob Storage and Azure Data Lake, database through Azure SQL Database and Azure Cosmos DB, and mapping services through Azure Maps (Google Cloud, 2024).

Google Cloud Platform is known for its powerful capabilities in big data processing and machine learning. In the context of routing systems, GCP offers computing resources through Google Compute Engine and Google Kubernetes Engine, data storage through Google Cloud Storage and Google Cloud Bigtable, databases through Google Cloud SQL and Google Cloud Spanner, analytics tools through BigQuery, and mapping services through Google Maps Platform. Integration with Google Maps Platform makes GCP an attractive choice for projects that require accurate and reliable mapping data (Microsoft Azure, 2024).

In the context of developing vehicle routing systems, it is important to evaluate cloud platforms on several criteria: scalability, performance, availability of routing tools, cost and security. All three platforms (AWS, Azure, GCP) offer high levels of scalability and performance. They provide the possibility to automatically scale resources depending on load, which is critical for systems that process data in real time. The computing resources and storage data services on these platforms provide high performance and low latency.

AWS, Azure, and GCP have integrated mapping services (Amazon Location Service, Azure Maps, and Google Maps Platform, respectively), which significantly simplifies the development of routing systems. These services provide capabilities for routing, traffic analysis and other functions necessary for the efficient operation of the system.

The cost of using cloud services depends on many factors, including the volume of resources used, the region of deployment, and the specific services. In general, AWS has a mid-range price level, Azure can be more expensive, especially when using additional services, while GCP often offers competitive pricing and

flexible payment terms. It is important to carry out a detailed cost calculation based on the specific requirements of the project.

All three platforms offer a high level of security, including data encryption, access control, and certification according to international standards. AWS has extensive experience in providing security and offers a wide range of security management tools. Azure integrates security with other Microsoft products, which can be useful for organizations already using the Microsoft ecosystem. GCP focuses on data privacy and security, using its own expertise in securing its global services.

*Table 1 – Comparative characteristics of systems*

<b>Criteria</b>	<b>AWS</b>	<b>Microsoft Azure</b>	<b>GCP</b>
Scalability	High	High	High
Performance	High	High	High
Cartography	Integrated	Integrated	Integrated
Cost	Medium	From medium to high	From low to medium
Security	High, with many certificates	High, integrated with Microsoft products	High, focused on privacy

The choice of a cloud platform for vehicle routing development depends on the specific project requirements, available resources, and priorities. AWS offers universal services and powerful computing resources, and also has a mapping service, Amazon Location Service, that simplifies the routing systems development. Microsoft Azure, with its integrated Azure Maps service, makes it easier to work with geospatial data and can reduce time to market, but can be a more expensive option. With powerful analytics tools and integration with Google Maps Platform,

Google Cloud Platform is an attractive choice for projects that require accurate mapping data and analysis of large volumes of information. Each platform has its own advantages and disadvantages, so the choice should be based on a detailed analysis of the specific project requirements, the technical capabilities of the platforms and economic factors.

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**Zhuha A. S.**

**ARTIFICIAL INTELLIGENCE: A PATH TO PROGRESS OR A DANGER?**

*Scientific Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*  
*Language Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*

When most people hear ‘artificial intelligence,’ they usually think of robots. Big-budget films and novels tell stories about humanoid machines wreaking havoc on the Earth. But this is quite far from reality. Artificial intelligence is based on the principle that human intelligence can be defined so that a machine can easily mimic it and perform tasks from the simplest to the most complex. The goals of artificial intelligence include imitating human cognitive activity. Researchers and developers in this field are making surprisingly rapid strides in mimicking activities such as

learning, reasoning, and perception to the extent that they can be precisely defined. Some believe that innovators will soon be able to develop systems that surpass the human capacity to learn or reason in any aspect. However, others remain skeptical because all cognitive activity is permeated by value judgments that depend on the human experience.

AI has many advantages, such as its applications. The technology is used in many different sectors and industries. For example, AI is being tested in the healthcare industry to suggest dosages of medications, determine treatments, and assist with surgical procedures in the operating room. AI also has applications in the financial sector, where it is used to detect and flag activity in banking and finance, such as unusual debit card usage and large account deposits, all of which help the banking department in the fight against fraud. AI applications are also used to optimize and simplify trading. This is achieved by streamlining the assessment of supply, demand, and prices for securities. AI is also widely used in education to help find information (Ямпольський, Ткач, Лісовиченко, 2011).

However, there are also limitations to artificial intelligence. It should be noted that despite fantastic successes - such as in the field of chess, where computer programs have long existed that can easily defeat even the world's strongest chess players, or the fact that a significant number of large companies operate chatbots that automate and speed up the processing of their customers' requests without the involvement of human operators - there are substantial and fundamental limitations, such as:

- AI systems successfully solve only a single type of task - the one for which these systems were designed from the very beginning;
- they cannot 'switch context,' switching from one type of task to another, as humans can do;
- To perform their task, artificial intelligence systems need training time and information about the 'reference truth.'

Of course, the benefits of AI are substantial, as society is pressed to increase efficiency and automation through AI. AI has also completely changed how companies communicate with their customers, enabling personalized experiences. In addition, AI is a catalyst for innovation and creativity in various industries; for example, in cybersecurity, AI is a powerful ally in identifying and responding to potential threats.

So, it should be noted that despite the great benefits of AI, it is dangerous for society because it makes people lazy by automating most of the work with its applications. There is a significant loss of jobs and problems with employment. AI's capabilities in automation increase efficiency but raise concerns about job losses. This proves that AI can and should exist but not replace humans in many aspects.

So, while AI offers significant advancements, it raises concerns about ethics, privacy, and employment. The future of AI has enormous potential, but it also requires careful consideration and constant monitoring of its social and ethical impacts.

It is also worth noting that education and artificial intelligence (AI) are becoming inextricably linked due to the vast opportunities that AI technologies offer to improve the learning process. This includes personalized learning (AI enables learning platforms to tailor materials to the individual characteristics and learning pace of each student), intelligent tutors (AI-based systems such as virtual assistants can act as intelligent tutors), automated assessment (AI helps automate the process of checking tests, essays or practical tasks), and adaptive learning systems (AI allows you to create adaptive learning platforms that 'learn' from students themselves. They analyse the learner's behaviour, progress, and adapt the learning process to suit their needs best) and much more.

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**Zhukovskyi V. E.**

### **THE ROLE OF ARTIFICIAL INTELLIGENCE IN CYBERSECURITY**

*Language Advisor – CandSc (Education), Assoc. Prof. Borzenko O. P.*

The advent of the information technology era has had a significant impact on business processes, data management, and information security. In 2023, the total losses from cybercrimes worldwide were estimated at \$8 trillion, posing serious challenges to both the private and public sectors. According to the World Economic Forum, this shows that people should not avoid developing technology solutions in industries where they have limited understanding, such as cybersecurity (World Economic Forum, 2024).

The integration of artificial intelligence (AI) into cybersecurity has become one of the most important strategies to counter modern threats. For example, AI systems are capable of processing up to 100 terabytes of data per day (Ferrag, Alwahedi, Battah, Cherif, Mechri, & Tihanyi, 2024). This significantly increases the effectiveness of threat analysis and the speed of response. Combined with increased data density, these innovations enable security teams to efficiently use fewer resources to solve current challenges.

One of the main practical applications of AI is threat detection in real time. Thanks to machine learning algorithms, such systems can analyze up to 95% of network traffic. Traditional methods often fail to detect anomalies (Sharma, 2023). In addition, automation of vulnerability management reduces the amount of manual work. For example, routine tasks can be reduced by 70% with Check Point tools

that significantly reduce the error rate (Shechtman, 2023). Such systems are also used to analyze user behavior and prevent zero-day attacks. Cybersecurity expert Sridhar Muppidi notes that AI helps solve problems faster when they arise (Muppidi, 2023).

Although progress in AI implementation is significant, this process still faces certain challenges. One of them is the quality of training data: incomplete or uneven data affects the accuracy of the system and causes false alarms (Muppidi, 2023). Another challenge is the vulnerability of the AI models themselves. For example, an attack on language models based on large-scale training data can lead to data modification or manipulation during the training phase. As a result, the algorithm starts to work incorrectly (Wang, 2024). Such technologies require careful implementation to ensure user trust and guarantee their rights. Ethical issues such as algorithm transparency and maintaining user trust are key to their effective use (Shechtman, 2023).

Attackers using AI pose another challenge. AI-based tools make phishing more sophisticated, attacks more automated, and malicious software creation faster than ever before. According to the World Economic Forum, such methods significantly complicate the work of security systems (World Economic Forum, 2024). However, the future of AI development in cybersecurity looks promising. Palo Alto Networks predicts that by 2024, large language models will become the basis for automating threat analysis and incident response (Wang, 2024).

The future of AI in cybersecurity undoubtedly promises significant advances in both threat detection and prevention. Predictive data analytics is becoming an important tool to predict potential attacks (Muppidi, 2023), while accuracy and reliability are provided by models created by specialized research centers (Ferrag, Alwahedi, Battah, Cherif, Mechri, & Tihanyi, 2024).

However, different industries have their own challenges: how to implement these technologies transparently; what ethical standards should be followed in their use; and whether they will be effective without the cooperation of companies,



governments, and academic institutions. Only by combining these three approaches, it is possible to ensure a digital world that is resistant to modern challenges (World Economic Forum, 2024).

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**Zubenko I. A.**

**ARTIFICIAL INTELLIGENCE - OUR FUTURE OR THE ABYSS?**

*Scientific Advisor – Cand. of Pedagogic Sciences, Assoc. Prof. Rudenko N.V.  
Language Advisor – Cand. of Pedagogic Sciences, Assoc. Prof. Rudenko N.V.*

Artificial intelligence (AI) is a technology that can change our lives for the better, but at the same time carries certain risks that should not be forgotten. In recent decades, the development of AI has become one of the main areas of scientific and technological progress. These systems are already used in various areas of our lives, from medicine and industry to entertainment and personal gadgets. However, along with the benefits offered by AI, there are also significant challenges and dangers associated with its use (Руденко, 2006).

One of the main advantages of AI is its ability to perform complex tasks quickly and with high accuracy. AI can process vast amounts of data, analyze it, and draw valuable conclusions. This allows scientists, doctors, engineers, and other professionals to improve their processes, find new solutions, and achieve better results.

Another important area of AI application is industry. AI can automate processes, increase efficiency, and reduce manufacturing costs. Thanks to robotics and intelligent systems, production has become more flexible and less dependent on the human factor. This improves product quality and ensures stability in cases where human staff may be affected by external factors, such as a pandemic or economic crisis.

The role of AI in science is also worth mentioning. Artificial intelligence has made it possible to quickly model complex physical processes, develop new materials, and analyze data in biology, chemistry, astrophysics, and others. AI algorithms help researchers find patterns in data that humans might otherwise miss, opening up new opportunities for scientific discovery.

However, along with the benefits, AI also brings several risks and dangers worth considering. One of the biggest concerns is the threat of losing control over AI. AI systems are becoming too autonomous, and making decisions without

human intervention can lead to undesirable consequences. For example, if AI is used in the defense sector, there is a risk that autonomous combat systems may act unpredictably or even make decisions that contradict ethical norms.

Another danger is the possibility of using AI for mass surveillance and control. Facial recognition and behavioral analysis technologies can restrict people's freedom and violate privacy rights. Some countries already use systems that monitor citizens and control their behavior using artificial intelligence. This poses severe threats to democratic rights and freedoms.

The problem of job loss is another challenge that society may face in the AI era. As artificial intelligence can perform many routine and even intellectual tasks, people may lose their jobs. This is especially true for manufacturing, logistics, and information processing professions. This could increase unemployment and social inequality if appropriate programs are not developed to retrain and support people who have lost their jobs.

In addition to technical risks, using artificial intelligence raises several ethical issues. One of the main issues is who is responsible for the decisions made by AI systems. If an autonomous system makes a mistake or causes harm, the question arises: who will be responsible for this - the developers, the users, or the system itself?

Artificial intelligence has enormous potential to improve people's lives but also brings new challenges. AI can significantly increase efficiency in many areas, from medicine to industry. However, dangers such as system autonomy, human control, job loss, and ethical issues require serious attention. To maximize the potential of artificial intelligence and minimize the risks, it is necessary to develop appropriate legislative mechanisms and ethical standards. Only in this way will society be able to create a future in which AI becomes an assistant and friend to humanity, not a threat.

Artificial intelligence is also transforming the education system, making it more flexible, adaptive, and accessible to all population categories.

AI technologies are making quality education more accessible through online courses, distance learning platforms, and free educational resources. This is especially useful for people who do not have access to traditional academic institutions.

AI can help improve foreign language learning, for example, through speech recognition and pronunciation correction systems. Virtual assistants can conduct interactive conversations and help interactively improve language skills. There are many advantages of AI in education, and they should not be forgotten.

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**Zui V. A.**

### **ARTIFICIAL INTELLIGENCE: PROGRESS OR RISK?**

*Scientific Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*  
*Language Advisor – Candidate of Philological Sciences, Assoc. Prof. Ptushka A. S.*

Artificial intelligence (AI) has become one of our time's key technologies, transforming how we live, work, and interact with information. Education is one of the areas that will undergo the most radical changes due to the introduction of AI. Software such as Chat-GPT has already caused a significant negative reaction, sparking numerous discussions about its impact on the educational process. AI is penetrating every aspect of human life but is also causing controversy over its potential benefits and threats to humanity. Some consider this technology extremely promising, while others consider neural networks dangerous.

AI has many benefits, including developing algorithms to improve their capabilities and perform tasks based on the data they receive without human intervention. AI also plays a key role in increasing the efficiency of operations through automation. Its use in various sectors, from industry to agriculture and

services, helps to optimize processes, reducing costs and increasing productivity. In addition, developing and implementing autonomous systems based on artificial intelligence is a significant advance in many areas. In the security context, AI can play an important role in helping to detect threats, analyze cybercrime, and prevent terrorist attacks. From autonomous vehicles and drones to robotic systems, AI is changing how we think about transport, logistics, and manufacturing. These technologies increase safety by reducing the likelihood of human error, improving operational capabilities, and opening up new perspectives in areas where accuracy, efficiency, and reliability are critical.

It is also worth noting that artificial intelligence can adapt the learning process, offering students individualized development routes. In addition, it can provide access to education for those who have previously faced restrictions; its use allows for remote learning in regions lacking teachers and resources. AI can provide learning materials, interactive classes, and the ability to communicate with experts in various fields, which expands access to quality education. AI can be used to create virtual tutors to help students learn complex subjects and facilitate access to knowledge on a global scale. Teachers can use AI to collaborate with students, allowing them to explore topics of interest in greater depth and gain more understanding from those they have not mastered.

AI-based innovations are already transforming how we create music, paintings, literature, architecture, and fashion. By automating routine and everyday tasks, AI frees up the human potential to focus on more creative projects. Collaboration between artificial intelligence and human creativity fosters innovation, expanding the horizons of what is possible in various fields - from product design to solving complex problems and generating new ideas.

As for the disadvantages of AI, one of the most significant threats associated with the development of artificial intelligence is massive labor automation, which could lead to the loss of many jobs in various sectors. The role of humans in labor processes is decreasing, which poses serious challenges to employment standards.

Routine and easily automated tasks may reduce the employment opportunities for certain positions. Many experts warn that automation could increase unemployment, especially among workers without specialized skills, and contribute to social inequality (Троцько, 2020).

The rapid progress in artificial intelligence also raises ethical challenges, as many of the decisions made by these systems can be difficult to understand and explain. For example, algorithms can make decisions in important areas such as healthcare, justice, or military operations, but the developers often cannot clearly define the mechanisms behind these decisions.

We should not forget about the lack of a human factor. Technology is superior to humans in terms of productivity but cannot replace the human relationships that form a team. The limitations of artificial intelligence in understanding complex human contexts reduce its effectiveness in certain situations. Emotions, cultural sensitivities, and broader socio-ethical issues remain beyond the precise understanding of machines. This limitation creates difficulties in cases where a deep understanding of the human context is critical to making informed decisions.

Thus, despite the many benefits of artificial intelligence, we must not forget that it is only a tool that can be useful and harmful to humanity, depending on how it is used.

## **References**

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ДЛЯ НОТАТОК

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Збірник наукових праць

Випуск 17

Частина 1

АРХІТЕКТУРА ТА БУДІВНИЦТВО  
ГУМАНІТАРНІ НАУКИ  
ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ  
ЕКОНОМІЧНІ НАУКИ

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Адреса редакції: 61002, м. Харків, вул. Ярослава Мудрого, 25, тел. 752-88-87