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TRACERS OF DISCS AND WINDS AROUND A HIGH-MASS YOUNG STAR (MWC297)**Huseynova F.***PhD, scientific worker**Nakhcivan State University**Nakhcivan, Azerbaijan*DOI: [10.5281/zenodo.14503322](https://doi.org/10.5281/zenodo.14503322)**Abstract**

This article is presented a new catalog of 108 Herbig Ae/Be candidate stars identified in the Pico dos Dias Survey, together with 19 previously known candidates and four objects selected from the IRAS Faint Source Catalog. These 131 stars were observed with low and or medium-resolution spectroscopy, and complemented these data with high-resolution spectra of 39 stars. The objects present a great variety of $H\alpha$ line profiles and were separated according to them. As is known that most of the time a Herbig Ae/Be star presents a double peak $H\alpha$ line profile. Correlations among different physical parameters, such as spectral type and $v \sin i$ with $H\alpha$ line profiles were searched. We found no correlation among $H\alpha$ line profiles and spectral type or $v \sin i$ except for stars with P Cygni profiles, where there is a correlation with $v \sin i$. In this work also used preliminary spectral energy distributions to seek for any influence of the circumstellar medium in the $H\alpha$ line profiles. The presence of [O I] and [S II] forbidden lines is used together with the $H\alpha$ line profiles and these preliminary spectral energy distributions to discuss the circumstellar environment of the Herbig Ae/Be candidates. The distribution of the detected [OI] and [S II] forbidden lines among different spectral types points to a significantly higher occurrence of these lines among B stars, whereas the distribution among different $H\alpha$ profile types indicates that forbidden lines are evenly distributed among each $H\alpha$ line-profile type. Combining the distance estimates of the Herbig candidates with the knowledge of the interstellar medium distribution, we have found that 84 candidates can be associated with some of the more conspicuous SFRs, being in the right direction and at a compatible distance.

Keywords: catalogs-circumstellar matter, clouds stars, pre-main-sequence, spectroscopic.

Characterized by their transitional nature, Herbig Ae/Be stars occupy a pivotal role in the study of stellar evolution. These young, pre-main-sequence stars exhibit spectral characteristics that place them between T Tauri stars and classical Be stars, thus providing valuable insights into stellar development processes. Typically located in star-forming regions, Herbig Ae/Be stars are surrounded by protoplanetary disks, which play a crucial role in their growth and subsequent evolution. The presence of these disks not only facilitates the accumulation of mass but also gives rise to complex interactions with stellar winds, influencing both the physical structure of the disk and the stars evolutionary path. Focusing on the role of disk and wind interactions, these processes are essential in shaping the characteristics and behaviors of Herbig Ae/Be stars. Stellar winds, which consist of streams of charged particles emitted by the star, can significantly impact the surrounding disk dynamics. As the wind interacts with the disk material, it generates shocks and instabilities, leading to enhanced mass loss and angular momentum transfer. This interplay not only affects the star's growth but also contributes to the dispersal of the surrounding material, potentially allowing for the formation of new planetary bodies. Understanding these interactions is crucial in creating a comprehensive picture of Herbig Ae/Be star evolution, particularly within groups such as MWC 297. Research on these phenomena reveals that the dynamics at play can vary substantially based on environmental conditions and individual stellar properties. By studying MWC 297, - insights into the broader processes governing young stellar systems and the even-

tual transition to main-sequence stars, ultimately refining our knowledge of stellar lifecycle stages and the formation of planetary systems.

Ever since the identification of the Herbig Ae/Be stars (HAeBes; Herbig, 1960) as a class of early-type pre-main sequence objects (Strom et al., 1972), these stars have taken centre-stage in star and planet formation studies. They have masses which place them in the transitional regime between Solar-type stars and high-mass stars. In detail, the change in star formation character between the high- and low-mass stars is the dichotomy between clustered and isolated formation, between boundary layer accretion and magnetospheric accretion, radiative and convective stellar interiors and between fast and slow rotation. Moreover, the discs around Herbig stars are in general brighter than around their low-mass counterparts, the T-Tauri stars. Therefore HAeBes are prime laboratories in which to study the evolution from actively accreting discs towards debris discs and mature planetary system.

1. spectral type A or earlier, with emission lines;
2. located in an obscured region;
3. fairly bright nebulosity in its immediate vicinity;
4. present an anomalous extinction law;
5. show infrared excess;
6. be photometrically variable; and
7. display line profiles of Mg II ($\lambda 2800$) in emission.

The first three tips were proposed by Herbig (1960) to define pre-main-sequence (PMS) stars of intermediate mass. The last four are an extension proposed by The' et al. (1994) to encompass the large set of new candidates. However, very few stars satisfy all

of them. One possible explanation is that the Herbig Ae/Be group spans a large range of evolutionary stages (Malfait et al. 1998).

Forbidden lines such as [O I] ($\lambda 6300$ and $\lambda 6364$) and [S II] ($\lambda 6716$ / $\lambda 6731$) trace the emission from low-density regions near the stars. The shape of the forbidden-line profiles can indicate the presence of disks or outflow characteristics. When a disk exists, these lines are expected to be blueshifted and asymmetric, as in T Tauri stars (TTSs) (Finkenzeller 1985), since the receding part of the outflow will be hidden by the disk. In H A e Be stars there is still a debate on the origin of the observed forbidden lines. Almost all observed [O I] lines are symmetric, and some authors (Bohm & Catala 1994) favor the idea of an origin in a spherically symmetric wind without the presence of disks.

Using the IRAS Point Source Catalog, TTS was based on dust properties and not on the star itself, selected criteria also included H A e Be stars. It is more difficult to be certain of the classification of a H A e Be star than of a TTS, because there is no feature like the Li ($\lambda 6707$) line as a clear signature of this class of objects.

Overview of MWC 297 and its significance in stellar formation studies

Located in the northern constellation of Cassiopeia, MWC 297 is pivotal in the study of stellar formation, particularly as a Herbig Be star showcasing both disk and wind processes. Its classification reflects a complex interplay of accretion and winds that influence the surrounding circumstellar environment. As noted, MWC 297's accretion rates and stellar parameters have implications that extend our understanding of the evolution of massive stars, with recent analyses revealing evidence for intense inner-disk photoevaporation in sources like MWC 297, significant for stars above (Vioque et al). Furthermore, the exploration of such stars enhances statistical studies into the accretion properties of Herbig Ae/Be stars, enabling researchers to hypothesize about the mechanisms of disk dissipation and the interaction between stellar and circumstellar material. Thus, MWC 297 serves as an essential case study for illuminating the processes that govern early stellar evolution.

Disk Processes in MWC 297

The study of disk processes in MWC 297 reveals crucial insights into the interactions between star formation and the surrounding circumstellar environment.

Observations suggest that intense Herbig Be stars like MWC 297 exhibit significant near-infrared excess, indicative of a robust inner disk structure that strongly influences accretion dynamics. This aligns with the findings regarding early HBe stars, which demonstrate high H α emission and active circumstellar environments, suggesting a complex interplay of material dynamics and star activity. Moreover, the detection of complex molecules and elements near young stellar objects in turbulent regions, such as those surrounding Sgr A*, highlights similar disk processes potentially at work in MWC 297. These processes not only facilitate star formation but also influence subsequent evolutionary pathways, as evidenced by the relationship between dense circumstellar environments and the eventual dispersal of protoplanetary disks. Understanding the nuanced role of these disk processes is essential for comprehending the evolution of young star groups like MWC 297.

Wind Processes in MWC 297

Understanding wind processes in MWC 297 reveals critical interactions between stellar outflows and surrounding material. Winds play a significant role in shaping the protoplanetary disks accompanying young stars, influencing both mass loss and accretion rates. As demonstrated in recent studies, the characteristics of these winds can be correlated with the stellar properties such as effective temperature and luminosity, affecting the evolution of the disk itself. (Ji Yeon Seok et al., p. 291-291) highlights how the photodissociation of polycyclic aromatic hydrocarbons (PAHs) varies with stellar temperature, suggesting that energetic radiation in MWC 297 leads to selective destruction of smaller PAHs. This process has implications not only for chemical composition but also for the dynamics within the disk. Furthermore, (J. Guzmán-Díaz et al., p. 182-182) indicates that transitional disk structures are often observed in young stars like MWC 297, underscoring how wind processes can contribute to the formation and dissipation of these disks, thus shedding light on the disk evolution in the context of wind interactions.

All eight of the main targets are known massive YSOs or Herbig Ae/Be stars. Some basic properties of these are given in Table 1.

Table 1.

Object	Distance (kpc)	Spectral type	Luminosity ($L_{\odot}$)	A_V (mag)	v_{LSR} (km s ⁻¹)
BD+40°4124/V1685	$\sim 1^1$	B3V ²		3.1 ³	$\sim 8^5$
Cyg					
GL 490	$\sim 1^6$		2000 ⁶	42 ⁷	-14^9
M17SW IRS1	1.3/2.1 ¹⁴	O9V ¹⁵		17 ¹⁶	$\sim 17^{17}$
M8E	1.25 ¹⁰		20000 ¹¹	39 ⁸	~ 11 13
MWC 297	0.25 ¹⁸	B1.5V ¹⁸		8 ¹⁸	2 – 20 ¹⁸
MWC 349A	1.7 ²²		60000 ²³	9 ²³	10 ²⁵
S106	0.5–1.7 ²⁶	O7.5V ²⁶		13.6 ²⁷	$\sim 5^{29}$
VV Ser	0.2–0.6 ³⁰	B6V ² /B9V ³¹		$\sim 3^{31}$	$\sim 10^{33}$

All the sources are sufficiently compact that they could be observed by nodding the telescope such that the sources remained on the slit (the measured beam

separation is 22 arcsec). In addition to target observations, this approach uses standard stars to offer crude flux calibration and adjust for atmospheric absorption

features. The standard stars were chosen to have a range of spectral type from G6V through to O9V. This provided enough range to enable us to correct for the observed Brackett line absorption in the standards themselves. Cooler stars were not used since they have many

other spectral features in the wavelength ranges observed, and in practice we used the hottest standard available for any target. The Brackett line absorption in the standard was interpolated over to remove it.

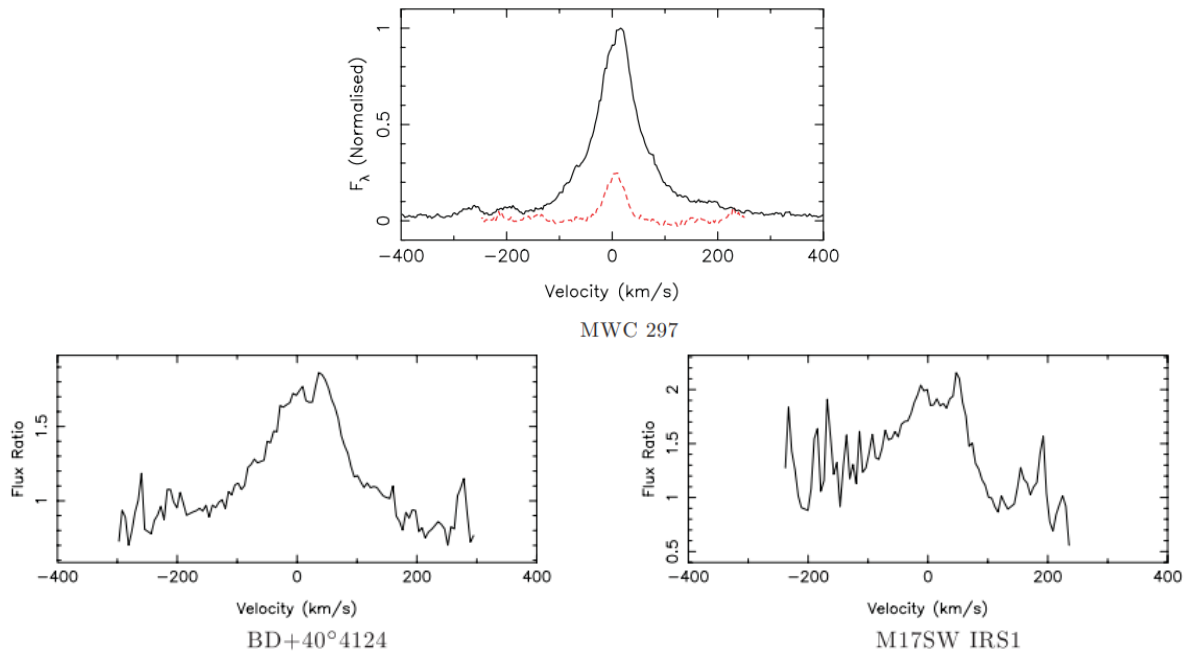


Figure 1. $\text{Br}\gamma$ (solid line) and $\text{Br}12$ (dashed line) line profiles after continuum subtraction, and correction for extinction.

The source's bias is debatable. Drew et al. (1997) found that a near edge-on inclination is necessary to explain the reported optical absorption line data, since otherwise the star would be near break-up velocity. Interferometry data is best modeled with a near-face-on orientation. An edge-on model may result in double-peaked line profiles if an ionized disc contributes. To align with previous studies, we use interferometric data to determine inclinations for this object. Murdoch & Drew's (1994) $\text{Br}\alpha/\text{Br}\gamma$ ratio is comparable to the $\text{Br}\gamma/\text{Br}12$ ratio of BD+40°4124 or M17SW IRS1, as seen in Figure 1. (Lumsden et al. 2012) measured line widths are consistent with Drew et al.'s (1997) $\text{Br}\alpha$ width. Although Br12 has a similar FWZI to $\text{H}\alpha$, Drew et al. found that $\text{H}\alpha$ has a greater FWHM. The Fe II profile does not feature the same broad wings. Most published MWC 297 spectra have symmetric Brackett line characteristics. Malbet et al. (2007) found that $\text{Br}\gamma$ exhibits blueshifted asymmetric self-absorption. The greater spectral resolution data published by Murdoch & Drew (1994) and Weigelt et al. (2011) do not reveal this, implying that variability exists. The $1.083\ \mu\text{m}\ 2^3\text{S}-2^3\text{P}\ \text{He I}$ line (Drew et al. 1997) shows a P-Cyg-ni effect, indicating the presence of a wind. For a face-on

orientation, this wind might be polar or disc-shaped with a wide opening angle.

Drew et al. give a 5 GHz radio map revealing resolved radio emission from this source on the size of $\sim 50\ \text{au}$. Both Malbet et al. and Weigelt et al. interferometry demonstrate the core $\text{Br}\gamma$ emission is more extended than the K-band continuous light. Weigelt et al.'s better spectral resolution measurements indicate that visibility is similar to the continuum beyond $60\ \text{km s}^{-1}$ from the line centre. An exponential is a better fit for the Br12 wings in this scenario. In comparison, the power-law fit has a low exponent of -1.3 ± 0.1 . The flat inner line core from Stark broadening, seen in Repolust et al. data and objects like BD+40°4124, is not here. A comparison of the strength of the line wings to peak intensity in the hydrogen recombination lines in the data reported here and in Drew et al. (1997) shows that the wings become stronger for lower n transitions in a reasonably uniform manner. This strongly suggests electron scattering. The fact that the wings and continuum appear to be equally visible in the Weigelt et al. data shows that this scattering happens at tiny scales. (Lumsden et al. 2012) focus on the scattering model for MWC 297 as it provides the strongest evidence of its presence.

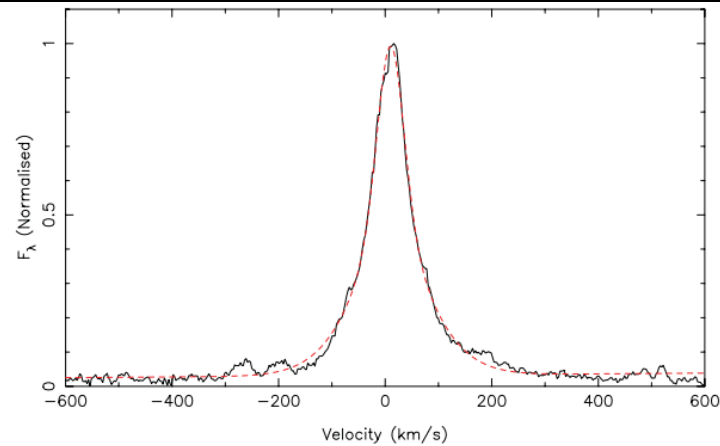


Figure 6. The best-fitting Castor et al. (1970) model to MWC297.

The Castor et al. model's best fit shows a reduced $\chi^2 = 2$, indicating a somewhat asymmetric line. Figure 6 illustrates the fit for this source. The opacity of Thomson scattering exceeds unity, indicating that the model's criteria are not met. The implied electron temperature ($T_e \sim 170 \pm 10$ K) is low and not physically significant. The match of the Castor et al. profile in a case when the intrinsic line core is very small supports scattering as the major mechanism, however this model is insufficient to accurately estimate critical scattering-related physical parameters. Acke et al. (2008) failed to fit their combined near and mid-infrared interferometry to a pure accretion disc model, implying that more than one component was present.

Malbet et al. suggest a combination of disc and a weak outflowing wind can explain their near-infrared interferometry and the observed P-Cygni profile in Br γ . However, they struggle to find a good fit to the red wing of the Br γ line because their model predicts disc shadowing, which is not seen. The same is true of the models applied to the high spectral resolution observations of Weigelt et al. (2011) as well (which otherwise reach a very similar conclusion to Malbet et al). However, the rather obvious evidence of considerable dispersion in the line wings mitigates this issue. In a face-on orientation, the absence of a visible line effect in Oudmaijer & Drew's (1999) spectropolarimetry is not important because such a signature requires an asymmetry in the source structure as seen on the sky, which is not present. Weigelt et al. found evidence of a rotating signature in Br γ during the differential phase, which would not be present in a face-on condition. Acke et al. (2008) propose an intermediate inclination as a compromise to harmonize the available facts.

Conclusion

In summary, the intricate interplay of disk and wind processes in young group stars like MWC 297 underscores the dynamic evolution of stellar environments. As researchers demonstrate that the accretion dynamics associated with the protoplanetary disk play a critical role in shaping the mass and composition of these stars. Furthermore, the outflowing winds not only contribute to the removal of angular momentum but also affect the surrounding interstellar medium, thereby influencing subsequent star formation and the chemical enrichment of the galaxy. The evidence gathered from

observations and simulations suggests that these processes are not merely isolated phenomena; rather, they are interconnected components that drive the life cycles of young stars.

The high series infrared hydrogen lines' strong line broadening mechanisms have the significant side effect of making them poor tracers of a wind or a disk when used alone. A better tracer of a breeze are probably the He I lines from metastable levels, although, unfortunately, not every YSO shows this emission. However, by broadening, the hydrogen lines offer a way to check for the presence of extremely dense circumstellar material.

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COMPUTER SCIENCES

INTEGRATED ARTIFICIAL INTELLIGENCE AS A MEANS OF OPTIMIZING THE EDUCATIONAL PROCESS IN THE CONDITIONS OF DISTANCE EDUCATION

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Abstract

The proposed article emphasizes the need to actively introduce the latest distance education technologies into the educational process, including those involving artificial intelligence. The developed system of distance education is described, which allows improving the educational process and increasing the convenience of the educational process for scientific and pedagogical workers and students of higher education through integration into the artificial intelligence system for creating tests. The developed system has a unique innovative functionality that allows you to easily create tests automatically using artificial intelligence.

Keywords: educational process, distance learning, computer system, artificial intelligence, design, modeling.

Introduction. Since the 90s of the last centuries, the world scientific and pedagogical community has been actively raising the issue of using alternative forms of educational activity, such as: distance learning, mediated learning, online learning, etc., which have gained special importance in connection with the development of the Internet [1–18].

Today's challenges require the scientific and pedagogical worker to transform not only the methods and techniques of teaching in higher education, but also the transition to a completely unusual mode of work using online platforms in the educational process. Moreover, it is not only about online education as a component of the educational process, but about the complete replacement of traditional education with online learning.

These issues have become especially relevant in 2020 due to the COVID-19 pandemic and developed during the war.

The main tools of the educational process in general and higher education in particular have become online services that provide the possibility of posting educational materials, organizing video meetings, conducting current and final examinations and keeping an assessment log. Google Classroom, Microsoft 365 and virtual educational spaces of universities based on the Moodle platform have become the main online platforms for the organization of e-learning in Ukrainian institutions of higher education, each of which has its own advantages and disadvantages [9].

Therefore, modern didactic science actively directs its developments in the direction of improving the available tools of online education.

The proposed study is devoted to the creation of a prototype system for distance learning. The developed system will be distributed under the name Educational Site, which fully reflects its main content.

Results. In the process of designing a software tool, it is not always possible to predict all aspects, so inaccuracies may appear during the creation of a prototype. This provides an opportunity to supplement the existing description with new information and get rid of them when creating a full-fledged system.

In the system under development, input data is filled by all participants, because they have special interfaces through which they enter information. For example, a teacher can create a test manually or using artificial intelligence, which will be transferred to the database, and then stored in tables, following the rules of normalization. During the test, the student will be able to view this data, which will be displayed after processing by the backend. The proposed system is based on the principle of client-server technology, which involves data exchange between the client and the server. From this follows the need for a high-quality Internet connection for the program to work.

When the user enters the site for the first time, the main page of the site opens, where the list of available courses is displayed in the foreground. In the left part there is a navigation menu with two buttons: authorization and registration, they are used to redirect to pages that will have their own forms. In order to enter the site, you need to register. After registering and authorizing according to the role, a navigation box will be displayed.

A navigation field with links to pages will be available for the student:

- view of the course, where links are presented, with the help of which joining to online lectures, laboratory works or review of theoretical material is performed;
- view the schedule, which is displayed for the whole week and is available for viewing, providing information about the schedule of classes;
- passing the test, where there is an opportunity to check your knowledge by running the test, in which the questions are displayed one by one, and after the test is completed, the final grade is shown;
- viewing the list of courses, he is studying.

For this role, the home page will show a list of courses the student is attached to, and navigating to each course will display a list of tutorials and tests that can be taken.

The following will be displayed for the teacher:

- creating a course on which fields with the following names are available: name, description;
- viewing the schedule, where it is possible to view the schedule of groups for a week, which provides a complete overview of the schedule of the educational process;
- review of grades, where you can view grades received by students after testing;
- creating a test, in addition, it is possible to create tests manually or generate them using AI.

On the main page, the teacher is presented with a list of courses to which he has joined. When switching to any course created by him, a functionality will be available where he will be able to add educational material, invite to an online lecture or create a test.

University departments have the following opportunity:

- creating a schedule, where you can create a schedule by adding information according to groups;
- group management, which contains information about all groups, as well as options for editing, deleting or adding new ones;
- course management, where you can manage courses, including creating, editing and deleting.

All pages are available to the administrator, as well as:

- editing, where it is possible to change all the information stored in the database: group, student, teacher, subject, schedule, etc. d. The ability to edit, add and delete, which provides full control over information in the system.

The administrator has full access to all functionality, including those that are closed to regular users.

The system must be ready to increase users and process a significant number of requests in a short period of time. As the audience increases, the amount of stored information also increases. With proper design, the stability and speed of the system should be ensured when the load increases.

In order to save memory and speed in the future at the stage of database design, it must be normalized, because the tables should not contain duplicate data, and since all the relationships between them are interconnected, when you delete a course, the related to it will be automatically deleted records.

The backend is responsible for managing the database, which is influenced by the frontend. That is, the database does not necessarily have to be on the same server, but if it is, then the speed of requests will be longer by a few hundredths of a second.

For secure communication between the frontend and the backend, a special key is added to the requests, which is automatically generated after each authorization and is used as a user identification when contacting the server, which ensures a high level of reliability and reduces the probability of unauthorized access.

The server must have the functionality to regularly back up data. This is necessary so that in the event of a fatal error there is an opportunity to restore the integrity of the data and avoid its loss.

It is also necessary to pay close attention to the user's data, which he enters during registration, in particular, his password. Security is ensured by storing the password in encrypted form. This is an important measure designed to ensure that in the event of a database breach, no one can access user data.

System modeling is one of the most important stages in software design. At this stage, an analysis of how the future product will be used is carried out, with a detailed description of the actions. This section also defines all users (actors) and the actions they will perform (precedents).

The construction of these diagrams is performed using a special modeling language – UML. This language was chosen due to the fact that it is standardized, and the scheme described by the rules will be understood by anyone who works with it.

The output of the proposed modeling will be using case and sequence diagrams. Based on the obtained results, you can move on to designing the architecture of the software tool and its implementation.

Let's first describe the system being developed at a conceptual level with the help of a use case diagram. It will allow to display the interaction of entities and actors of the project with precedents.

The following elements of the system can be distinguished:

- users: administrator, department employees, student, teacher, and to make it more convenient, another "user" actor was created, which will combine a department employee, student, and teacher. Also in the diagram is a "system" actor that accepts requests from others;

- precedents: login to the system, CRUD operations on data, view grades, view schedule, course management, subject management, course study.

Let's move on to a brief description of each precedent:

- login to the system – describes authorization, it also provides for the possibility of registration or displaying an error in case of entering incorrect data;

- CRUD operations on data – describes how the administrator performs work on information: editing, creating and deleting records;

- view ratings – describes how the user can view information related to ratings;

- viewing the schedule – the user can view the schedule of his group;

- course management – describes how a department employee can manage a course, also extended by the ability to manage groups, which are complemented by schedule management;

- subject management – describes how the teacher can manage the subject, which is extended by theory and test management;

- studying the course – describes how the student can study the course, theory and tests.

Sequence diagram – it is used to depict how objects interact in an orderly manner in time and their aspects. With the help of such diagrams, they display the life cycle during which the interaction of an actor with the system is performed within the framework of the current precedent. Its purpose is to display objects in dynamics, information is provided in the form of messages, and interaction involves exchanging them within the scenario.

Before designing a system prototype, you need to choose the right architecture, because the work and existence of the development system depends on it.

Choosing a software architecture is one of the most important roles and is the most important in software development. It contains components, their properties and relationships between them. That is, it describes the principle of organization of components in the system. Documenting this architecture simplifies the communication process, predicts flaws, and makes it possible to reuse templates in other projects. A properly designed architecture can save time and money, as well as increase the speed of the development product.

Currently, the leaders in architecture are monolithic and microservice, so let's consider them in more detail.

Monolithic is an architecture that is developed as a single package, meaning the software will be packaged into a single monolith and deployed in the same way. In the architecture of this type, only one technology is used, due to the fact that the program is assembled in one place, it is easy to add new features to it, and it runs in one place and is autonomous, it has a high speed of exchange between modules, because they are next to each other in the same code and work within the framework of one software tool.

Microservice is an architecture that follows a modular type of development, that is, it consists of independent parts, modules that can be used in different applications, but at the same time they exchange information using methods (interfaces). In this type of architecture, each component is independent and can be implemented in different programming languages.

In the proposed study, the system will be designed according to the architecture of the monolith, because the software tools of this type are easily deployed within the framework of one server, are easily developed and have high performance due to the fact that the components are close to each other within the same code. But the disadvantage of this approach can be that over time the system code is modernized and increased, which in the end can lead to the fact that the code becomes overloaded and difficult for the developer to understand.

For a better understanding of how the program will work on physical equipment, a special deployment diagram is used – a special diagram that shows the components: web servers, database servers, or the application server, as well as how they interact with each other.

The client opens a page using a web browser and sends various commands to the server without even realizing it. Special software is installed on the server, which makes it possible to run a site written in the php programming language, as well as a MySQL database. The client and server communicate using the HTTPS protocol.

When accessed from the client's web browser, it sends special requests to the Laravel application, which receives them and forwards them to the router. After the router has processed this request, it calls a special controller class. This class accepts the entire request and, if necessary, receives data to work with later, or immediately provides a response in the form of JSON code.

These actions are performed according to the rules of the MVC design pattern, because the entire Laravel framework is built according to this pattern. It was created to facilitate the work of developers so that if we decipher this abbreviation, we will get three words “Model-View-Controller”. A model is a class through which any kind of communication with a database is performed, a view is what is displayed to the user, a controller is all business logic.

In more detail, the router calls a controller that is selected from a list of all routes and can interact with the model and perform some business logic. After all interactions, it starts generating a response to the client's web browser in the form of JSON, which is displayed to the user.

For convenient development and editing of Laravel in the file hierarchy models, views and controllers are stored in different directories according to the structure of Laravel.

The main Model manages the entire database, and from it inherits the User Model, Schedule Model and System Model models, which have the main data set they are responsible for. These models are controlled by three controllers: User Controller, Schedule Controller and System Controller, which will work with their data depending on the desired result: creating new records, deleting, editing or displaying them.

Conclusion. Today, online training is used in the preparation of higher education applicants of all specialties. Among its indisputable advantages, the following can be highlighted: long-term strategy; flexibility, democracy, the opportunity to more fully implement the individual educational trajectory of applicants and a student-centered approach to learning; the level of absolute success and the quality of education of higher education applicants does not decrease; helps to overcome barriers and increase the level of ownership of digital technologies; promotes the development of creative and innovative teaching methods, including personalization of the educational process, increasing the level of cooperation both between students and between teachers, lecturers and students, promotes cooperation; provides access to domestic and foreign educational resources, etc.

The presented system contains the following types

of users: student, teacher, department employees and administrator. The student has the right to review existing and subscribed courses, schedules, theoretical materials, and passing tests. The teacher and the employees of the respective departments have the ability to create, modify and delete the data corresponding to their roles. The administrator has full rights and can interact with any data stored in the system.

The developed mathematical model makes it possible to determine that time saving when using artificial intelligence to create a test can reach almost 62.5%, which allows to significantly reduce the teacher's time consumption. With such an opportunity, it is possible to develop tests of various levels of complexity, and this allows to identify gaps in the knowledge of higher education applicants and to effectively adjust the educational process.

An analysis of the subject area was also carried out, the possibilities were clearly delineated and the requirements for users with different roles were described, the main functionality of the system was outlined, and possible easy expansion of the functionality in the future was taken into account.

Before development, various modern tools were analyzed and favorites were chosen, namely: the Laravel framework, the React library, and the ChatGpt service for using artificial intelligence.

A monolithic architecture is chosen, which is best suited for a system of this type.

As a result of the use of these tools, a fully functional distance learning system with the integration of artificial intelligence was implemented, which fully meets the tasks set at the beginning of the project.

After development, comprehensive testing, validation and code minimization were performed in order to improve the weight and loading speed of the site. An experiment with the creation of a test using AI confirmed the effectiveness of the system, which means that the goal of the work has been achieved.

The test implementation of the project on the Internet included the description of instructions for search robots, the activation of indexing in Google search and the use of the semantic core for the selection of keywords in order to improve the search visibility of the site.

The obtained result shows that the system is ready for implementation, meets the set tasks, has the potential for further development, contributes to the optimization of distance learning for students of higher education and scientific and pedagogical workers.

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ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ ПІДТРИМКИ ПРИЙНЯТТЯ РІШЕНЬ В БІЗНЕС ПРОЦЕСАХ

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Анотація

У статті розкривається важливість інформаційної підтримки для ухвалення управлінських рішень в сучасних бізнес-процесах. Підкреслюється, що сучасні інформаційні системи відіграють вирішальну роль у підвищенні ефективності діяльності підприємств, сприяючи прийняттю рішень на основі аналізу попередніх виконань процесів. Запропонований напівавтоматизований підхід використовує методи добування даних для виявлення ключових закономірностей між контекстом, рішеннями та результатами процесів. Проаналізовано основні функції, призначення та напрями вдосконалення інформаційних систем підтримки рішень, а також продемонстровано їхній вплив на конкурентоспроможність і економічну безпеку підприємства. Підхід був оцінений через симуляцію реальних виробничих процесів, що показало його значний потенціал для оптимізації управлінських рішень та зростання продуктивності. Автоматизація ухвалення рішень на основі правил, сформованих через аналіз минулого досвіду, дозволяє підприємствам швидко адаптуватися до змін та ефективно досягати своїх цілей в умовах постійної конкурентної боротьби.

Abstract

This article reveals the importance of information support for managerial decision-making in modern business processes. It emphasizes that contemporary information systems play a crucial role in enhancing enterprise efficiency by facilitating decisions based on the analysis of previous process executions. The proposed semi-automated approach utilizes data mining methods to identify key patterns among the context, decisions, and outcomes of processes. The main functions, purposes, and directions for improving decision support information systems are analyzed, demonstrating their impact on the competitiveness and economic security of the enterprise. The approach was evaluated through the simulation of real production processes, showing significant potential for optimizing managerial decisions and increasing productivity. Automation of decision-making based on rules formed through the analysis of past experience allows enterprises to quickly adapt to changes and effectively achieve their goals amid constant competitive pressures.

Ключові слова: система підтримки прийняття рішень, інформаційні технології, автоматизація рішень, бізнес-процеси, інформаційна безпека, економічна безпека.

Keywords: decision support system, information technologies, decision automation, business processes, information security, economic security.

Вступ

У сучасному світі бізнесу, де швидкість ухвалення рішень і гнучкість є вирішальними факторами успіху, підприємства постійно шукають нові шляхи для оптимізації своїх процесів і підвищення продуктивності. Сучасні бізнес-процеси охоплюють широке коло рішень на всіх рівнях управління, які впливають на кінцевий результат. Ці рішення можуть стосуватися вибору шляху виконання процесу, управління ресурсами чи визначення стратегій для досягнення певних бізнес-цілей.

Попри те, що існують численні моделі і процедури для ухвалення управлінських рішень, багато рішень все ще базуються на інтуїції, особистому досвіді або навіть випадковості, що часто не дає можливості досягти оптимальних результатів. У таких випадках, навіть якщо керівники враховують ситуаційні фактори, наприклад, ресурси або специфіку замовлень, це може не забезпечити достатньо точного й ефективного управління процесами.

Протягом останніх десятиліть дослідження в галузі інформаційних технологій та систем підтримки ухвалення рішень суттєво розширили можливості для вдосконалення бізнес-процесів. Систематичний підхід до прийняття рішень з використанням історичних даних і сучасних технологій, таких як майнінг даних, дозволяє підприємствам ідентифікувати найбільш продуктивні сценарії. Цей процес значно підвищує точність рішень, особливо в умовах невизначеності.

У цій статті ми пропонуємо напівавтоматизований підхід до ухвалення рішень, який поєднує в собі використання накопичених даних, алгоритмів аналізу процесів і симуляцій для формування правил, що забезпечують максимальну продуктивність бізнес-процесів. Підхід базується на тому, що можливо вивести оптимальні шляхи виконання процесів у різних контекстах, використовуючи історію минулих виконань процесів. У статті також продемонстровано практичну цінність цього підходу через симуляцію реальних бізнес-сценаріїв.

Огляд літератури

У сфері підтримки ухвалення рішень у бізнес-процесах існує кілька підходів, що широко використовуються в сучасних дослідженнях. Одним із таких підходів є **Case-Based Reasoning (CBR)**. Цей підхід, згідно з дослідженням Schott та ін. (2020), дозволяє підприємствам використовувати попередній досвід для вирішення нових проблем. У своїй роботі автори досліджують застосування CBR у виробничих системах в рамках концепції Industry 4.0. Використання минулих випадків для ухвалення рішень є корисним, особливо коли йдеться про повторювані процеси, проте цей підхід має певні обмеження. Зокрема, він більше фокусується на схожості випадків, а не на аналізі досягнутого результату, що є важливим для оцінки ефективності процесів.

Іншим перспективним методом є **байєсові мережі**, що дозволяють моделювати ймовірнісні залежності між елементами процесу. Dumas та ін. (2013) підкреслюють важливість байєсових мереж для ухвалення рішень у бізнес-процесах в умовах невизначеності. Цей підхід є надзвичайно корисним для прогнозування різних сценаріїв розвитку

подій, проте його недоліком є висока складність і вимога до значних обчислювальних ресурсів, що може стати бар'єром для багатьох підприємств, особливо невеликих.

У сучасних дослідженнях також активно розвивається використання **методів машинного навчання** для ухвалення рішень у бізнес-процесах. Kim та ін. (2018) показують, що алгоритми кластеризації та регресії є ефективними для оптимізації бізнес-процесів, особливо у великих організаціях з великими обсягами даних. Проте ці методи мають певні обмеження, оскільки вони вимагають значних обчислювальних ресурсів і великої кількості даних для навчання моделей, що не завжди є доступним.

Ще одним важливим підходом є **процесне добування даних (Process Mining)**, запропоноване Van der Aalst та ін. (2016). Цей підхід дозволяє аналізувати журнали подій та історії виконання процесів, виявляти неочевидні закономірності та надавати рекомендації для вдосконалення бізнес-процесів. Хоча процесне добування даних більше фокусується на минулих подіях, наш підхід пропонує інтегрувати не тільки минулі випадки, але й контекст процесів, що дозволяє отримати більш точні й адаптовані рішення для конкретних ситуацій.

У підсумку, хоча кожен з описаних підходів має свої переваги, вони мають певні обмеження в умовах складності сучасних бізнес-процесів. Наш підхід об'єднує кілька елементів цих підходів, дозволяючи інтегрувати минулий досвід, контекст виконання процесу та результати для формування гнучких і точних правил ухвалення рішень, що допомагає підвищувати продуктивність бізнесу.

Основна частина

У сучасному світі бізнесу, де швидкість інновацій та технологічного прогресу визначають лідерів ринку, роль інформаційних технологій для підтримки ухвалення рішень стає ще більш вагомим. Швидкі зміни на ринку, постійна конкуренція та глобалізація вимагають від підприємств здатності швидко адаптуватися до нових умов і приймати обґрунтовані рішення на всіх рівнях управління. Інформаційні системи підтримки ухвалення рішень дозволяють підприємствам ефективніше обробляти великі обсяги даних, аналізувати результати попередніх виконань процесів та прогнозувати майбутні сценарії, що є надзвичайно важливим для збереження конкурентних переваг.

Підприємства, які впроваджують такі системи, можуть швидше адаптуватися до змін ринкових умов, оптимізувати свої бізнес-процеси та ухвалювати більш точні рішення, що сприяє досягненню стратегічних цілей. Крім того, сучасні інформаційні системи дають можливість ідентифікувати ризики та керувати ними завдяки аналізу минулих даних і прогнозуванню можливих загроз. Це, в свою чергу, дозволяє знижувати витрати, підвищувати якість наданих послуг та збільшувати загальну ефективність підприємства.

Зі зростанням ролі таких технологій, як штучний інтелект, машинне навчання та великі дані, інформаційні системи стають невід'ємною частиною стратегічного управління підприємством. Впровадження цих технологій дозволяє організаціям не

тільки підвищувати свою продуктивність, а й забезпечувати високу гнучкість у прийнятті рішень, що є критично важливим для успішної діяльності в умовах швидкозмінного середовища. Отже, дослідження та розробка нових підходів до інформаційної підтримки ухвалення рішень стає ключовим напрямком для сучасного бізнесу, що прагне забезпечити собі стійке лідерство на ринку.

Проблематика

Попри значний розвиток інформаційних систем та технологій, сучасні підприємства продовжують стикатися з низкою викликів у сфері підтримки ухвалення рішень. Однією з ключових проблем є **недостатня інтеграція інформаційних систем** у загальну структуру бізнес-процесів. Через це виникає фрагментація даних, що призводить до уповільнення процесів ухвалення рішень, помилок та втрати актуальної інформації. Часто це ускладнює ефективну координацію між відділами підприємства, що негативно впливає на загальну продуктивність і якість прийнятих рішень.

Іншою серйозною проблемою є **якість даних**, зокрема їх актуальність і повнота. Неповні або застарілі дані можуть призвести до неправильних висновків, що, в свою чергу, сприяє ухваленню неефективних рішень, знижує конкурентоспроможність підприємства і може призвести до значних фінансових втрат. Це особливо важливо для галузей, де точність і своєчасність рішень є критичними, таких як фінанси, виробництво або охорона здоров'я.

Зі зростанням складності самих інформаційних систем з'являється ще одна проблема — **технологічна складність**. Чим складніші системи, тим більше навичок і ресурсів потрібно для їхнього налаштування та підтримки. Це створює додаткові бар'єри для впровадження нових технологій, особливо для малих і середніх підприємств, які можуть не мати достатніх фінансових або кадрових ресурсів для управління такими системами.

Крім того, важливою проблемою залишається **зміна бізнес-вимог**. У швидкозмінних ринкових умовах інформаційні системи повинні бути достатньо гнучкими, щоб оперативно адаптуватися до нових умов. Однак багато підприємств стикаються з тим, що їхні існуючі інформаційні системи не здатні швидко змінюватися, що робить їх менш ефективними у нових ринкових реаліях.

І нарешті, **безпека даних** є ще однією важливою проблемою. У зв'язку зі зростанням кількості кібератак і витоків інформації, питання захисту конфіденційних даних стає дедалі актуальнішим. Це вимагає від підприємств значних інвестицій у технології захисту даних та їхню інтеграцію у систему ухвалення рішень, щоб гарантувати збереження цілісності інформації, яка використовується для управлінських рішень.

Концептуальні основи

Для того, щоб підвищити продуктивність бізнес-процесів, важливо розглядати їх з трьох основних аспектів: рішення, контекст та результати. Ці три елементи повинні бути взаємопов'язані, щоб забезпечити ефективне функціонування процесу та досягнення бізнес-цілей.

Рішення: Бізнес-процеси передбачають ухвалення рішень на різних рівнях. Це може бути вибір між кількома альтернативними шляхами виконання процесу, визначення необхідних ресурсів або вибір стратегії досягнення цілей. Наприклад, у виробничому процесі рішення можуть стосуватися оптимального розподілу працівників або вибору матеріалів. Ці рішення безпосередньо впливають на те, чи буде процес успішним і наскільки ефективно він досягне своїх цілей.

Контекст: Кожен бізнес-процес виконується в конкретному контексті, що може включати зовнішні умови (економічне середовище, конкуренція) та внутрішні фактори (ресурси, обмеження часу, склад команди). Наприклад, в контексті медичних процесів контекстом може бути вік або стан пацієнта. Контекст допомагає краще адаптувати процес до поточної ситуації, що дозволяє ухвалювати більш точні рішення.

Результати: Результати процесу можна вимірювати за двома основними параметрами: досягнення "жорстких" цілей (наприклад, доставка товару або завершення послуги) та "м'яких" цілей, таких як ефективність, якість або витрати. Наприклад, у випадку виробництва "жорсткою" ціллю може бути завершення замовлення, тоді як "м'якою" — якість кінцевого продукту або час виконання.

Наш підхід полягає у використанні методів майнінгу даних для вивчення взаємозв'язків між контекстом, рішеннями та результатами. Використовуючи історичні дані про виконання процесів, ми можемо виводити правила ухвалення рішень, що дозволяють оптимізувати продуктивність процесу. Цей підхід відрізняється від таких методів, як Case-Based Reasoning (CBR), тим, що ми не лише враховуємо подібні випадки, але й інтегруємо інформацію з усіх попередніх процесів для формування комплексних правил ухвалення рішень.

У кінцевому результаті, цей підхід дозволяє більш точно підвищувати ефективність процесів, адаптуючи їх до конкретних умов та вимог. Завдяки цьому бізнес-процеси стають більш гнучкими і здатними досягати своїх цілей у мінливих середовищах.

Процедура навчання

Для підвищення продуктивності бізнес-процесів за допомогою нашого підходу ми розробили чітку процедуру навчання, яка ґрунтується на методах аналізу минулих виконань процесів. Ця процедура включає кілька ключових етапів:

1. **Видобуток даних:** Процедура починається зі збору історичних даних про виконання бізнес-процесів. Ці дані охоплюють різноманітні аспекти виконаних процесів, включаючи прийняті рішення, умови виконання (контекст) та результати, отримані в результаті процесу. Наприклад, дані можуть містити інформацію про вибір ресурсів, зміни у вимогах або затримки на різних етапах процесу.

2. **Аналіз даних:** Використовуючи методи майнінгу даних, ми аналізуємо отримані дані для виявлення закономірностей між контекстом, рішеннями та результатами. Алгоритми дозволяють ви-

явити, які рішення приводили до найкращих результатів у певних ситуаціях. Наприклад, аналіз може показати, що певні рішення працюють краще в умовах обмеженого часу або при обмеженості ресурсів.

3. Побудова правил ухвалення рішень: На основі результатів аналізу ми формуємо правила ухвалення рішень, які стають основою для автоматизації процесу прийняття рішень у майбутньому. Ці правила описують, які рішення потрібно приймати в конкретних умовах для досягнення найкращих результатів. Наприклад, в умовах високого завантаження виробничої лінії, система може рекомендувати перенаправлення завдань на інші ресурси для оптимізації часу виконання.

4. Оцінка ефективності: На завершальному етапі ми проводимо симуляцію для оцінки ефективності сформованих правил. Симуляція дозволяє перевірити, наскільки ці правила здатні покращити продуктивність процесів у різних умовах. Для цього ми використовуємо симуляцію реальних виробничих або бізнес-процесів, порівнюючи результати з базовими показниками. Це допомагає виявити, чи здатні правила покращити ключові показники ефективності, такі як швидкість виконання, зниження витрат чи покращення якості.

Наш підхід дозволяє організаціям використовувати накопичений досвід для систематичного вдосконалення процесів. Виведені правила ухвалення рішень можуть бути використані для прийняття кращих рішень у майбутньому, що дозволяє підвищити продуктивність і забезпечити більш гнучке управління бізнес-процесами.

Оцінка результатів

Для того щоб оцінити ефективність нашого підходу, ми використовуємо симуляцію виробничого процесу. Симуляція дозволяє перевірити, наскільки добре сформовані правила ухвалення рішень впливають на продуктивність бізнес-процесів. Основна мета цього етапу — визначити, чи покращують ці правила ключові показники ефективності (KPI) та чи дозволяють вони досягти поставлених бізнес-цілей у різних контекстах.

1. Створення набору даних: У нашій симуляції ми генеруємо два набори даних: перший є базовим, що відображає початковий стан виконання процесів без змін, а другий — це маніпульований набір, який дозволяє оцінити ефективність нових правил. Цей підхід дозволяє чітко побачити різницю між традиційним виконанням процесів і тим, як вони виконуються із застосуванням нових правил ухвалення рішень.

2. Застосування правил: Ми застосовуємо отримані правила ухвалення рішень до маніпульованого набору даних. Правила використовуються для автоматизації прийняття рішень на різних етапах процесу. Наприклад, якщо симуляція показує, що в умовах обмежених ресурсів рішення про перенаправлення завдань на інші робочі лінії дає кращі результати, ці правила автоматично застосовуються до відповідних сценаріїв.

3. Вимірювання продуктивності: Ми порівнюємо результати симуляції між базовим і маніпульованим наборами даних, використовуючи кілька

ключових показників продуктивності (KPI). До таких показників можуть належати час виконання процесу, зниження витрат, рівень задоволеності клієнтів або якість кінцевого продукту. Вимірювання цих показників дозволяє нам чітко оцінити, наскільки нові правила ухвалення рішень здатні покращити продуктивність.

4. Аналіз результатів: На основі отриманих даних ми проводимо глибокий аналіз того, як впливають нові правила на бізнес-процеси. Аналіз допомагає виявити найбільш ефективні рішення в різних контекстах і дає змогу зрозуміти, де ще можливі покращення. Наприклад, може виявитися, що певні правила добре працюють в умовах великого навантаження, але менш ефективні в умовах низької активності. Такий аналіз дозволяє вдосконалювати правила й адаптувати їх до різних бізнес-ситуацій.

Таким чином, оцінка результатів допомагає нам зрозуміти, наскільки ефективно працюють наші правила ухвалення рішень і як вони можуть бути застосовані для підвищення продуктивності у реальних бізнес-середовищах. Висновки з цієї оцінки можуть бути корисними для організацій, які прагнуть автоматизувати процес прийняття рішень та досягти кращих результатів у своїй діяльності.

Висновки

Запропонований нами підхід до покращення продуктивності бізнес-процесів має кілька ключових переваг, що робить його актуальним у сучасних умовах. На відміну від підходів, які базуються на ручному аналізі або інтуїтивному прийнятті рішень, наш підхід автоматизує процес формування критеріїв ухвалення рішень, спираючись на досвід минулих виконань процесів. Це дозволяє виявити найкращі рішення для конкретних контекстів, що забезпечує підвищення ефективності та досягнення кращих результатів.

Основною перевагою нашого підходу є інтеграція трьох ключових елементів:

1. Що було зроблено в минулих екземплярах процесу, тобто конкретні шляхи та ухвалені рішення.

2. Контекст, в якому виконувалися ці процеси, що дозволяє адаптувати рішення до поточних умов.

3. Оцінка результатів або бізнес-продуктивності, що досягнута під час виконання процесів.

Цей підхід відрізняється від інших методів, таких як Case-Based Reasoning (CBR) або методи машинного навчання, тим, що він дозволяє не лише повторювати успішні рішення з минулого, але й адаптувати їх до нових контекстів. Наприклад, як зазначено в дослідженні Schott та ін. (2020), CBR добре працює для управління складністю у виробничих системах, проте наш підхід дозволяє враховувати не лише подібність випадків, але й оцінювати їхній контекст і результати.

Подібно до процесного добування даних, описаного Van der Aalst (2016), наш підхід також використовує історичні дані для виявлення кращих шляхів у процесі, але додатково враховує контекст кожного процесу, що робить наш підхід більш

комплексним. Він також може використовувати методи, що застосовуються в машинному навчанні для аналізу великих обсягів даних, як у дослідженнях Kim та ін. (2018), але не вимагає таких обчислювальних ресурсів і може адаптуватися до змінних умов із меншими витратами.

Таким чином, наш підхід дозволяє ефективно покращувати продуктивність бізнес-процесів завдяки автоматизованому формуванню критеріїв ухвалення рішень на основі досвіду, що робить його актуальним у сучасному бізнес-середовищі, де зміни і невизначеність є постійними викликами.

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PERSONALIZATION OF MARKETING STRATEGIES USING AI AND EXPANDING OPPORTUNITIES FOR EFFECTIVE CONSUMER ENGAGEMENT**Tretiakov I.***MBA, The Kellogg School of Management at Northwestern University,
USA, Evanston*DOI: [10.5281/zenodo.14503344](https://doi.org/10.5281/zenodo.14503344)**Abstract**

This article examines modern methods and approaches to personalizing marketing strategies using artificial intelligence (AI) technologies. An analysis is conducted of the main AI tools, such as machine learning (ML), big data analytics, and natural language processing. Their role in creating segments and hyper-segments, predicting consumer behavior, and automating marketing campaigns is also explored. The article discusses the benefits, potential limitations, and challenges associated with implementing AI in marketing, such as privacy concerns, transparency, and the required investments.

Keywords: AI-driven marketing, personalized marketing strategies, consumer segmentation, behavioral prediction, big data analysis, machine learning (ML).

Introduction

The personalization of marketing strategies becomes a key area of focus in modern business development. In an environment of growing customer demand for unique offerings, companies are striving to adopt a more individualized approach for each client. Artificial intelligence (AI) technologies play a vital role in this process. They enable businesses to analyze large volumes of data and predict consumer behavior. Companies can create personalized marketing strategies that enhance the effectiveness of customer interactions.

Various AI technologies open new opportunities for a deeper understanding of customer needs. Recommendation systems allow companies to suggest products or services that best match the user's interests. While chatbots provide quick interactions and real-time customer assistance, it remains important to consider that implementing these technologies involves technical, ethical, and legal challenges. As the processing of personal data necessitates maintaining confidentiality and data protection.

Personalized marketing approaches enabled by AI allow for more relevant offerings and create opportunities for effective real-time communication with customers. Brands seek to leverage AI to analyze past interactions with users and predict their future preferences. The emergence of these technologies transforms traditional approaches to customer engagement. It helps companies enhance the customer experience (CX) not only by creating more accurate and relevant messages but also by providing tailored offers or discounts taking into account life time value (LTV) of the exact customer. It is particularly important to examine how various AI tools influence interaction effectiveness and enable closer collaboration with customers. The goal of this study is to analyze methods and approaches for personalizing marketing strategies using AI. This article investigates the use of AI in enhancing marketing personalization strategies. It examines key AI tools and their applications in segmenting audiences, predicting consumer behavior, and automating marketing campaigns.

Main part. Analysis of AI technologies for marketing personalization

Various AI systems play an important role in enhancing personalized marketing strategies. They offer

companies new ways to connect with consumers on a deeper level. A range of AI tools contribute to this process. Machine learning (ML), big data analysis, and natural language processing (NLP) stand out as the core pillars. Each of these technologies provides unique capabilities in processing and interpreting complex data sets.

Models based on ML allow for the continuous refinement of marketing models by identifying patterns in consumer actions. They usually include both internal and external data flows. Internal data may include purchasing history, browsing habits, and interaction frequency, while external data may include everything that affects consumer behaviors such as weather, holidays, or other seasonal factors that we can get history on. As algorithms learn from this data, they can predict future behaviors with remarkable accuracy. This method helps marketers not only to deliver more precise and targeted content but also improve Return on Investment (ROI) by targeting customers who will convert to target action (purchase) with higher probability. Big data analysis enables the organization and examination of large volumes of both structured and unstructured data [1]. The technology offers insights into broader trends and consumer sentiments that may otherwise go unnoticed.

One of the most significant applications of AI in marketing personalization is **recommendation systems**. Leveraging historical data on consumer preferences, browsing behaviors, and even external factors, recommendation engines can suggest products or services tailored specifically to each consumer's interests. E-commerce platforms extensively utilize these systems to propose complementary items or similar products that might appeal to the user based on past actions. This approach boosts the likelihood of conversions and enhances the customer's engagement by making the shopping journey more relevant. Recommendation engines can refine their accuracy over time through collaborative filtering and content-based filtering techniques [2].

Chatbots represent another transformative AI-driven technology in personalized marketing. They are specifically programmed to engage with customers in real-time. These AI chat agents are capable of answering questions, guiding users through the purchasing

process, and providing personalized assistance. Modern chatbots are equipped with NLP models and can understand and respond to customer inquiries with a high degree of accuracy. They often tend to mimic human conversation. This tool enables chatbots to interpret the nuances of language, such as sentiment and intent. It allows them to respond more empathetically and accurately. This immediacy provides customers with faster and more efficient service, and gather real-time feedback that can inform further personalization efforts. Through interaction with a client, chatbots can collect data on preferences and frequently asked questions.

With the rise of digitalization, investments in conversational AI tools have surged as companies allocate resources to enhance customer engagement and maintain a competitive edge. Startups like ASAPP, specializing in conversational AI for customer support, exemplify this trend by offering technologies that automate customer interactions and improve CX through conversation analysis and real-time recommendations. According to 2023 statistics [3], ASAPP and other chatbots focused on customer support received the most funding (fig. 1).

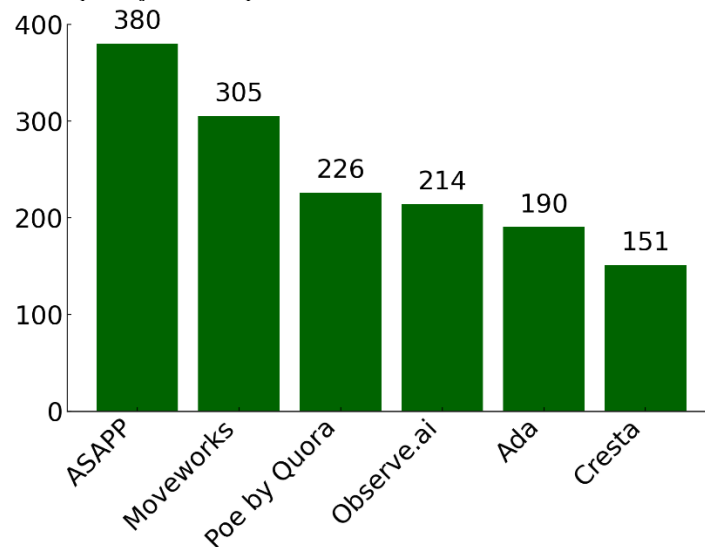


Figure 1. Leading chatbot/conversational AI startups worldwide in 2023, million dollars

Understanding the customer journey can be important for delivering relevant marketing that resonates with consumers at every touchpoint. **Customer journey mapping powered by AI** provides insights into the sequential steps a consumer takes from initial awareness to purchase and post-purchase interactions [4]. By using AI to analyze a combination of browsing behavior, past interactions, and purchasing history, companies can construct a highly detailed map of the customer journey. Predictive analytics and ML algorithms are central to this approach. They help businesses anticipate each stage of the journey. These tools also identify

where consumers may require additional engagement or support. If a customer shows interest in a particular product without purchasing it, the AI model can prompt retargeting ads or send follow-up emails tailored to their preferences. This approach aids in understanding and optimizing individual journeys. It enhances the CX by reducing friction and delivering relevant content at every stage. Despite the advantages and effective application of such technologies, a number of limitations arise in this regard (table 1).

Table 1.

AI integration challenges in personalized marketing [5]

Challenge	Explanation
Privacy and data security	Personalization relies heavily on data, raising privacy and security concerns. Compliance with strict data protection regulations is necessary to secure consumer data and build trust.
Investment and expertise	Significant financial investment and skilled personnel are required for developing, deploying, and maintaining AI models, making it challenging for some companies to adopt these technologies.
Transparency	Transparency in how AI uses consumer data is essential to foster trust. Providing consumers with options to manage personalization can alleviate concerns about data exploitation.

Modern AI technologies such as ML, big data analysis, and NLP serve as powerful tools for businesses who aim to enhance personalized marketing strategies. For successful implementation of these tools, companies must carefully navigate the challenges associated with privacy, investment, and transparency. They also need to ensure that AI-driven personalization remains both ethical and effective.

Methods and approaches to building personalized marketing strategies

The development of effective personalized marketing strategies is contingent upon the utilization of sophisticated AI-driven methodologies. These key approaches include creating segments and hyper-segments using AI, developing personalized offerings based on behavioral prediction, and automating marketing campaigns to monitor their effectiveness. Each

of these methods involves using specific AI technologies. They enable businesses to deliver precise, timely, and relevant content tailored to their consumers' needs.

Traditional marketing segmentation often relies on basic demographic information, such as age, location, or income, to divide consumers into groups [6]. **Segmentation systems** based on AI now enables the creation of far more nuanced and dynamic hyper-segments. This aspect is achieved by analyzing detailed behavioral data. It includes browsing patterns, past purchases, and interaction frequencies. Various ML algorithms can detect patterns within these behaviors and identify micro-groups that traditional methods might overlook. Rather than targeting all young adults with a general campaign, AI can identify specific subgroups, such as "young adults interested in sustainable fashion," or "frequent travelers with a preference for eco-friendly products». By using clustering algorithms and predictive analytics, AI allows marketers to create hyper-specific audience segments [7]. The unique approach makes marketing communications more precise and effective. This high level of segmentation allows companies to respond rapidly to changing consumer preferences and market trends.

Behavioral prediction powered by AI changes the way personalized offerings are created. Through predictive analytics and ML models, companies can anticipate consumer needs and preferences even before they are explicitly expressed. By analyzing historical data, such as past purchases, time spent on certain product pages, or responses to past marketing campaigns, the technology can forecast future actions and tailor product recommendations, promotions, or content accordingly. This approach is particularly effective in e-commerce, where recommendation engines provide personalized suggestions based on each user's behavior. If a customer frequently searches for outdoor gear, a predictive model can highlight relevant seasonal items or bundle deals. The right tool can enhance both CX and the likelihood of purchase. Sentiment analysis can be applied to social media data or customer feedback, allowing companies to gauge consumer moods and attitudes. By developing and delivering offers that feel intuitive and relevant, companies can significantly boost engagement and customer satisfaction.

Automation in marketing, particularly when powered by AI, introduces a new level of sophistication to campaign management. Through marketing automation platforms that integrate AI capabilities, companies can streamline processes such as sending personalized emails, managing social media ads, or delivering in-app notifications. AI-driven automation allows these campaigns to be dynamically adjusted in real-time based on consumer interactions. If a customer clicks on a promotional email but does not make a purchase, the system can automatically follow up with a reminder or offer a targeted discount or even change the offer, test it on the sample, and roll out the offer if test was economically feasible. These systems can optimize campaign scheduling, sending messages at the most opportune times for each user based on past engagement patterns. Monitoring the effectiveness of these campaigns is made possible through performance analytics and **automated A/B testing** [8]. They are enhanced by AI's ability to process large data sets, identify needed sample and its

structure, and identify patterns more quickly than manual analysis. Companies now can maintain a consistent and highly responsive marketing approach.

Creating segments and hyper-segments, developing personalized offerings based on behavioral prediction, and automating marketing campaigns are powerful AI-driven methods that are shaping the future of personalized marketing. Each of these approaches contributes to more meaningful, tailored consumer interactions. The innovative tools help brands establish stronger, long-lasting connections with their audience.

Conclusion

Personalization strategies driven on AI technologies represent a transformative approach in modern marketing. They offer businesses unprecedented tools to connect with consumers on a deeper, individualized level. Through advanced segmentation, predictive modeling, and automated campaign management, AI enables companies to deliver relevant, timely, and highly personalized content. The effective implementation of these strategies also requires careful consideration of privacy, investment, and transparency challenges. As companies increasingly leverage AI for personalization, balancing technological capabilities with ethical responsibilities will be essential for fostering consumer trust and achieving long-term success.

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CONSTRUCTION AND ARCHITECTURE

OPTIMIZATION OF QUALITY CONTROL METHODS IN CONSTRUCTION: INNOVATIVE APPROACHES AND THEIR EFFECTIVENESS

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Abstract

This article analyzes modern quality control methods in the construction industry aimed at improving the reliability, safety, and durability of constructed facilities. It examines innovative approaches, including the use of robotic systems, drones, and various digital technologies. Optimization methods such as standardization, process automation, predictive analytics, and non-destructive testing are explored. The article emphasizes the importance of implementing these technologies to optimize all stages of construction, increase productivity, and reduce risks.

Keywords: quality control, construction industry, optimization, standardization, automation, predictive analytics, robotic systems, digital technologies.

Introduction

Quality control in the construction industry is one of the most essential processes directly affecting the reliability, safety, and durability of structures. A high level of quality reduces the risk of accidents and helps avoid costly rework. It becomes especially significant in complex and long-term construction projects. Therefore, the process itself must be as precise, consistent, and comprehensive as possible to ensure that structures meet strict standards and requirements.

For many years, traditional control methods have been used in construction, including visual inspections and laboratory material testing. These methods played a foundational role in establishing quality systems, but as structures become more complex and project timelines more demanding, there is a growing need for modernized approaches. Implementing contemporary quality standards requires companies to adopt more flexible and comprehensive control tools that can respond to deviations in the early stages of construction and quickly address potential defects.

As the scale and complexity of construction projects increase, so does the need for new methods to improve control processes. Among these methods are the use of digital solutions, sensor systems, and artificial intelligence (AI) technologies, which enable high-precision data collection and analysis. These innovations

are designed to enhance quality control efficiency, optimize costs, and minimize errors. The aim of this study is to explore modern quality control methods in the construction sector and evaluate their effectiveness.

Main part. Innovative approaches in quality control methods

Modern construction becomes an increasingly complex and multilayered process, involving multiple stages and participants. In this context, quality control is one of the key elements that ensures structures meet standards of safety, durability, and functionality. With the rapid development of technology, construction companies are increasingly adopting innovative approaches that optimize quality control and construction processes [1].

Building Information Modeling (BIM) technology enables data management related to construction projects in a digital model format. The use of BIM at all stages of construction allows for quality control of the project based on comprehensive and up-to-date information. A primary advantage of BIM is the ability to predict potential errors and discrepancies even at the design stage. Among other benefits, the tool also enables the automation of control and reporting processes, simplifying the identification and correction of errors (fig. 1).

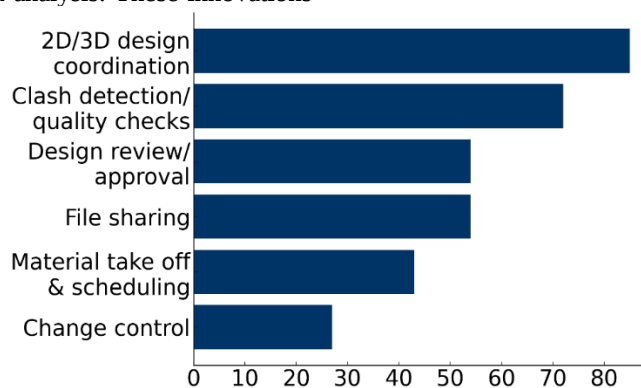


Figure 1. Worldwide survey results on optimization of BIM processes in corporate settings in the construction sector, 2022, % [2]

The system enables the prediction of potential errors and inconsistencies as early as the design phase,

making this innovation an important element in creating a transparent, integrated approach to quality management throughout the entire project lifecycle.

The integration of **sensor systems** and **Internet of Things (IoT)** technologies in the construction industry opens new possibilities for quality control. These tools allow for real-time data collection and analysis regarding the condition of the site. Sensors installed at various stages of construction gather information about parameters that affect the quality and safety of structures. Furthermore, it can identify building materials with a high accuracy of 82,75%, which increases to 83,07% when combined with remote sensing data from technologies like LiDAR (Light Detection and Ranging) [3]. Modern IoT systems consolidate this data and provide a comprehensive view of the process. The integration of IoT with BIM creates opportunities to build digital twins, providing a complete real-time view of the condition of the construction site.

The integration of **drones (UAV, unmanned aerial vehicles)** into construction processes has become

one of the most effective innovations in quality control [4]. They provide precise visual data that is difficult to collect using traditional methods, enabling more comprehensive monitoring of construction sites. Drones can conduct regular inspections of construction sites to assess their current state and track progress. These devices can capture images from different angles and heights, covering the entire site and identifying areas requiring special attention. Drones also enable inspections in hard-to-reach and hazardous areas of construction sites.

These devices also help detect defects and potential issues at early stages, reducing the likelihood of costly rework and delays. Equipped with high-quality cameras and thermal imaging sensors, drones can identify cracks, corrosion, leaks, and other defects in structures, as well as perform thermal inspections to detect areas with heat loss or potential insulation issues. Modern UAV in construction are equipped with advanced technologies that enable precise assessment of structural quality (table 1).

Table 1.

Characteristics of components of modern UAV used in the construction industry [5]

Technology needs/components	Description
Vehicle type: rotary-wing	Composed of one or multiple propellers. Do not require runways, as they can take-off and land vertically. High hovering capabilities. Considered safe and stable due to propellers redundancy. Low flying endurance.
Flying style: autonomous flights characteristics used	Auto-Return Home. Auto take-off/landing. Obstacle avoidance. Way-point navigation. Guarded motion. Follow target.
Onboard sensors	Visual cameras. Thermal cameras. Motion detection. LiDAR. Audio sensors. RFID readers. Air quality sensors.

With technological advancements, the construction industry is actively adopting **robotics** and **automation** to enhance accuracy and efficiency in tasks. These systems help execute labor-intensive and repetitive tasks with minimal human involvement, thus reducing costs and improving quality control. A primary area of robotics is the use of specialized construction robots capable of performing repetitive tasks at high speed and precision. An example is brick and block laying, where specialized robots like SAM100 (Semi-Automated Mason) can lay bricks with speed and precision that far exceed human capabilities [6]. Robots can pour concrete and smooth surfaces, ensuring uniformity and quality of finishes. They are equipped with cameras and sensors that enable automated inspection of structures for defects and deviations from project standards.

Augmented Reality (AR) technologies enable the overlay of a project's 3D model onto the physical structure. It allows for a direct comparison between the planned design and the actual state on the construction site. Workers can visually assess how the completed structure should appear and identify any discrepancies with the project in real time. By viewing the projected model directly on-site, they gain immediate insights into alignment, positioning, and design accuracy. This tool assists workers in monitoring the precision of their work and adjusting deviations as they occur. These systems can be specifically valuable in complex engineering tasks. With AR, construction teams can verify that each component is correctly positioned, as it ensures

that the project aligns with specifications down to the finest details.

Innovative approaches, such as drones, BIM, IoT, and robotics, contribute to the optimization of quality control methods in construction. Integrating these technologies allows construction companies to achieve high quality standards, reduce costs, and minimize human error.

Optimization of the quality control process

Quality control in construction encompasses multiple stages, from verifying project documentation to inspecting finished structures. With increasing demands for quality and efficiency in construction processes, optimizing quality control has become a priority for companies aiming to minimize errors, enhance reliability, and reduce costs.

One of the initial steps toward optimizing quality control is the **standardization** of all stages in the construction process. Using standardized checklists and guidelines ensures a consistent approach to inspections and quality checks at all levels. This method also helps reduce the number of errors and omissions during quality assessments by applying a structured approach. Standardizing processes facilitates the identification of causes for defects and deviations, as the sequence of actions affecting quality can be easily traced. The gradual implementation of standardized procedures enables companies to maintain consistent high standards across all their projects.

Digitalization and **automation** are key elements of optimization that make quality control more efficient and precise. Automation systems help minimize human involvement in inspections, reducing the likelihood of errors and enhancing real-time monitoring. The advantages of automation include automated data collection and analysis. Digital platforms and sensor systems allow for real-time gathering of information about the site's condition and quality parameters, thus accelerating the decision-making process.

One of the advanced technologies in quality control optimization is **predictive analytics**, which uses data analysis from previous projects to forecast potential issues at the current construction stage. By identifying patterns and correlations within large data sets, predictive analytics can help construction teams anticipate structural weaknesses, material failures, and scheduling delays before they arise, allowing for a more proactive approach to project management.

The application of **AI** and **machine learning** enables the detection of hidden dependencies and risk factors that may go unnoticed with traditional quality control methods [7]. These algorithms can learn from historical project data and sensor feedback, continuously improving their accuracy in predicting issues as more data becomes available. This process improves risk assessment and enables dynamic adjustments to construction workflows based on real-time feedback.

Non-destructive testing (NDT) methods allow for the inspection of construction materials and structures without causing damage, significantly improving the quality control process. Key NDT methods include ultrasonic testing, radiographic testing, and magnetic testing. These technologies enable the assessment of material strength and quality at every stage of construction [8]. Ultrasonic testing uses high-frequency sound waves to detect internal flaws, such as cracks or voids, within concrete or metal elements, providing precise data on material thickness and consistency. Radiographic testing, employing X-rays or gamma rays, reveals hidden defects by capturing detailed internal images of materials. It is commonly applied for inspecting welds and joints. Magnetic particle testing is particularly effective for ferromagnetic materials, where magnetic fields highlight surface and near-surface flaws that may otherwise be overlooked.

Optimizing the quality control process requires a comprehensive approach that includes process standardization, automation, and the use of advanced technologies for monitoring and data analysis. These meth-

ods enhance the accuracy and efficiency of quality control, making the construction process more economically viable and safer for all participants.

Conclusion

Innovative methods and optimization of quality control processes have become key elements of successful construction projects. The adoption of new technologies, such as drones, sensor systems, and automated platforms, enhances the accuracy and responsiveness of control, reducing costs and minimizing human error. Process standardization, task automation, and improved coordination among project participants facilitate smoother workflows and ensure adherence to high-quality standards. The use of predictive analytics and non-destructive testing helps anticipate and prevent defects. This approach makes the construction process safer, more reliable, and economically efficient.

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МЕТОДЫ ИССЛЕДОВАНИЯ ЛОЯЛЬНОСТИ ПОТРЕБИТЕЛЕЙ**Салманова Л.***Докторант Бакинского Государственного Университета***METHODS OF MEASURING CONSUMER LOYALTY****Salmanova L.***Doctoral student of Baku State University*DOI: [10.5281/zenodo.14503366](https://doi.org/10.5281/zenodo.14503366)**Аннотация**

В статье рассматриваются понятие и сущность лояльности клиентов, методы измерения лояльности клиентов, а также рассматриваются преимущества и недостатки каждого метода определения лояльности клиентов.

Abstract

The article explores the concept and essence of customer loyalty, methods for measuring customer loyalty and consider advantages and disadvantages of each method for determining customer loyalty.

Ключевые слова: лояльность потребителей, методы измерения лояльности, уровень лояльности потребителей.

Keywords: customer loyalty, methods for measuring customer loyalty, level of customer loyalty.

В условиях развития современных рыночных отношений концепция потребительской лояльности является крайне актуальной. Существуют много определений с помощью которых можно понять сущность данной концепции. Наиболее известное определение было сформулировано Джакоби Дж., Честнат Р., которое гласит: «Потребитель, лояльный бренду, – это человек, который покупает ваш бренд в 100% случаев».¹ Иначе говоря лояльный потребитель – это человек, который приобрел какой-либо товар или услугу у конкретной компании, в процессе у него сформировался положительный клиентский опыт и эмоциональная приверженность к бренду, и в итоге, он решает продолжить закупки товаров и услуг у той же фирмы на долгосрочной основе. Данная концепция особенно актуальна в современных условиях развития рыночных отношений. Так как конкуренция между компаниями ужесточается, а завоевание каждого нового клиента с точки зрения маркетинговых расходов обходится крайне дорого, фирмы пытаются удержать и выстроить со своими текущими клиентами долгосрочные отношения и сформировать потребительскую лояльность.

Какими же способами организации могут вычислить уровень потребительской лояльности и поддается ли эта концепция вычислениям? Ученными были разработаны различные методы исследования потребительской лояльности, но в целом эти методы можно подразделить на две большие группы: речь идет о математических и эмпирических методах. Эмпирические методы исследования

направлены на выявления наличия лояльности и определения ее уровня. Чаще всего для с этой целью используются опросы, проведение анкетных исследований. Математические методы используются для того, чтобы построить кривую лояльности, определить уровень лояльности, рассчитать влияние факторов, которые могут оказать воздействие на лояльность.

Одним из методов является метод разделения потребностей, который был разработан в 50-е гг. благодаря Д. Аакеру, Ж. Хофмейру, Б. Райсу.² Данный метод основывается на определении соотношения количества покупок товара определённого бренда на общее количество покупок. Таким образом, если потребитель из 10 покупок купил 6 товаров определённого бренда, то лояльность данного потребителя к этому бренду составляет 60%. На основе данного метода клиент считается лояльным в случае, когда процент повторных покупок выше 67%. Если проанализировать, этот метод имеет значительные недостатки. Поскольку при определении уровня лояльности, не учитываются такие качественные факторы как причины покупки товара, является ли потребитель действительно приверженцем этого бренда, или на его решение покупки оказали воздействие другие факторы.

В качестве другого метода можно выделить метод конверсионной модели, который был предложен Ж. Хофмейром и Б. Райсом. В данной модели учитываются 4 основных показателя:

- Удовлетворенность брендом
- Альтернативы на рынке

¹ Аренков И.А. 1, Константинова О.А. 2, Аренков Ф.И. Эволюция понятия «потребительская лояльность» и его современное наполнение [Электронный ресурс] Экономика, предпринимательство и право.2020-

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² Широценская И. П. Основные понятия и методы измерения лояльности // Маркетинг в России и за рубежом. - 2004. - № 2.

- Важность выбора бренда
- Колебания

Чем выше удовлетворенность потребителя определенным брендом, тем выше вероятность перехода потребителя в приверженца бренда. Альтернативы. Причина, по которой потребители не меняют бренд на альтернативный является понимание, что новый бренд хуже. Важность выбора бренда. Чем большее значение для потребителя имеет выбор бренда, тем больше вероятность того, что он потратит время на то, чтобы принять окончательное решение относительно того, какой бренд выбрать. Колебания. Этот фактор является ключевым в модели. Для окончательного выбора потребителю нужен дополнительный стимул.

Метод Райхельда. Автор считает, что истинно лояльный потребитель будет активно рекламировать и рекомендовать бренд среди своего окружения, тем самым создавая приток новых клиентов.³ На сегодняшний день большинство компаний используют именно эту методику, в основе которой лежит идея определения показателя NPS (Net Promoter Score (NPS), или Индекс потребительской лояльности). Вычисление NPS базируется на отве-

тах пользователей по шкале с баллами на вопрос «Готовы ли вы порекомендовать компанию друзьям?».

Как проводить NPS-опрос

1. **Необходимо сформулировать вопрос.** В процессе формулирования вопроса важно сделать его коротким, чтобы не утомить читателя. Предусмотрите, чтобы на него можно было ответить по шкале с баллами — иначе не сможете собрать исчерпывающую статистику. Пример формулировки:

Какова вероятность, что вы порекомендуете нас кому-либо?

2. **Необходимо разработать форму опроса.** Для этого есть много удобных сервисов, в том числе бесплатных. Например, google-формы.

3. **Запустите опрос и забудьте о нем** на 3–4 недели: нужно собрать достаточное количество ответов.

4. **Выгрузите ответы** и проанализируйте результат.

5. **Подумайте, как добиться лучших результатов** в следующий раз.

Данный математический метод разделяет потребителей на три группы: «Промоутеры», «Нейтралы» и «Критики».⁴



0-6 баллов — критики (детракторы). Оставляют о вас гневные отзывы, и если еще не нашли вам замену, то скоро найдут.

7-8 баллов — нейтралы. Относятся к вам нормально, но как только им попадет на глаза кто-то получше, они с радостью уйдут.

9-10 баллов — промоутеры. Ваши давние клиенты, «внештатные маркетологи» вашего бизнеса. С ними проще выйти на контакт, они часто оставляют положительные отзывы и «отвечают» за сарафанное радио.

Данный метод можно оперативно и без сложностей внедрить, так как проводя короткие опросы вы не утруждаете потребителей, в то же время вам легко будет проанализировать полученные данные

и принять соответствующие управленческие решения.

Данные методы помогут организациям получить нужную информацию для дальнейшей работы с потребителями. Компания сможет использовать полученные данные для повышения лояльности к бренду, тем самым увеличить количество новых потребителей и укрепить свою позицию на рынке. В будущем, при изменении ситуации на рынке, с учетом полученной информацией о потребителях, компании будет легче адаптироваться под внешние факторы среды.

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GEOGRAPHY

NAXÇIVAN MUXTAR RESPUBLİKASINDA İQLİM DƏYİŞMƏLƏRİNİN SƏHRALAŞMA PROSESİNƏ TƏSİRİ VƏ AQROEKOLOJİ QIYMƏTLƏNDİRİLMƏSİ

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THE IMPACT OF CLIMATE CHANGE ON DESERTIFICATION PROCESSES AND AGROECOLOGICAL ASSESSMENT IN THE NAKHCHIVAN AUTONOMOUS REPUBLIC

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Xülasə

Naxçıvan Muxtar Respublikasının iqlimi və digər təbii coğrafi təsirlər buranın landşaftında ciddi dəyişikliklər yaratmışdır. Arid iqlim Arazboyunda və alçaqdağlıq zonalarda səhra landşaftı yaratmış, digər təsirlər isə bu prosesi sürətləndirmişdir. Hazırda bu problem geniş vüsət almışdır. Ümumilikdə səhralaşma prosesi tədqiq edilmiş, səhralaşmanın yaranma səbəbləri təhlil edilmişdir.

Abstract

The climate and other natural geographical factors of the Nakhchivan Autonomous Republic have caused significant changes in its landscape. The arid climate has created a desert landscape in the Araz River basin and low mountain zones, while other factors have accelerated this process. Currently, this issue has gained widespread attention. In general, the desertification process has been studied, and the causes of desertification have been analyzed.

Açar sözlər: səhralaşma, yarımsəhra, təbii coğrafi təsirlər, iqlim dəyişmələri, aqrar təsirlər.

Keywords: desertification, semi-desert, natural geographical impacts, climate change, agricultural impacts.

Problemin aktuallığı. Müasir dövrün qarşısında duran ən mühüm problemlərdən biri də səhralaşma prosesidir. Bu prosedə bir sıra amillər təsir edir. Bu amillərdən ən əsası isə iqlim dəyişmələridir. Məlumdur ki, son dövrlərdə bəşəriyyəti məşğul edən vacib məsələlərdən biri global istiləşmədir. Qlobal iqlim dəyişmələrinin qarşısını almaq üçün bütün dünya ölkələrində vacib tədbirlər həyata keçirilir. O cümlədən Azərbaycan da bu problemə qarşı qoruyucu tədbirlər planı həyata keçirən ölkələrdəndir. Azərbaycan Respublikasının 65 % - nin subtropik qurşaqda yerləşməsi bu məsələni başlıca prioritet hesab edir.

Qlobal iqlim dəyişmələri təbiətə ciddi zərərər vurur ki, səhralaşma bunun ən bariz nümunəsidir. Alimlər vurğulayır ki, son 100 illikdə havanın temperaturu 1° artıb. Bununda 0.75° - si son 10 illiyimizə təsadüf edir. Azərbaycan Respublikasının 50 % - i yarımsəhra və quru çöl iqlimində yerləşir. O cümlədən Naxçıvan Muxtar Respublikası da qışı şaxtılı, yayı isti və quraq keçən iqlim tipində yerləşir. Bu səbəbdən Naxçıvan Muxtar Respublikasında səhralaşma daha aydın nəzərə çarpır. Səhralaşmaya təkcə iqlim dəyişmələri deyil həmçinin antropogen amillər də təsir edir. Bu sahədə çoxlu araşdırmalar aparılmışdır.

Məhz Naxçıvan Muxtar Respublikasında səhralaşma ocaqlarının yaranma mexanizmlərinin, onun inkişaf intensivliyinin müxtəlif landşaft komplekslərində təzahür xüsusiyyətlərinin müəyyənəşdirilməsi böyük elmi – praktiki əhəmiyyət kəsb edir.

Naxçıvan Muxtar Respublikasında səhralaşma prosesinin inkişafına insanların təsərrüfat fəaliyyəti, iqlim dəyişmələri ilə yanaşı lokal amillər də böyük təsir

edir. Bunları dəqiq tədqiq etmədən problemə qarşı qoruyucu tədbirlər planı həyata keçirmək düzgün deyil.

İşin əsas məqsədi : Naxçıvan Muxtar Respublikasının arid geokomplekslərində səhralaşma prosesini tədqiq etmək, səhralaşmanın aqrar zərərərini öyrənmək və onlara qarşı mübarizə tədbirlərinin planını hazırlayıb həyata keçirməkdən ibarətdir.

Tədqiqat metodları : Elmi məqalənin yerinə yetirilməsində çöl tədqiqat, tarixi, müqayisə, geokimyəvi metodlardan istifadə edilmişdir.

Naxçıvan Muxtar Respublikasının iqlimini Ə.M.Şıxlinski, Ə.Əyyubov, N.S.Mirzəyev, S.Bababəyev, İ.V.Fiqurovski və başqa alimlər tərəfindən öyrənilib tədqiq edilmişdir.

Səhralaşma probleminin inkişafı Muxtar Respublikanın iqlimi ilə birbaşa bağlıdır. İqlim yaradan ünsürlər, günəş radiasiyası, səth albedosu, yüksək termik qradiyent, mümkün buxarlanma, külək və s. səhralaşmanın inkişafı üçün təbii zəmin yaradır.

Muxtar Respublikanın iqlimi özünəməxsusluğu ilə fərqlənir. Bu bənzərsizlik onun təbii şəraiti, relyefi, yüksək günəş radiasiyası, müxtəlif atmosfer prosesləri və s. ilə bağlıdır.

Hazırda Muxtar Respublika ərazisində formalaşan səhra və yarımsəhra landşaftı günəş radiasiyası ilə birbaşa bağlıdır. Bu ərazi Respublikamızın ən bol radiasiya alan ərazisi olmaqla günəşli saatların çoxluğu ilə fərqlənir. Arazboyu ərazilərin günəşli saatlarını və aldığı günəş radiasiyasını müqayisə etsək, bu əraziləri yalnız Orta Asiyanın düzən əraziləri ilə qarşılaşdırıla bilərik. Muxtar Respublika ərazisində günəşli saatların miqdarı bir qayda olaraq 2600 – 2700 saat, dağətəyi ərazilərdə isə 2500 – 2600 saat, yüksək dağlıqlarda isə 2000 – 2400 saat təşkil edir.

Arazboyunun düzənlik və orta dağlıq ərazisi il ərazində 145 – 160 kkal/sm², yüksək dağlığı isə 150 – 160 kkal/sm² günəş radiasiyası alır. Bu kəmiyyət ərazidə səhrələşmə prosesi üçün bilavasitə təbii zəmin yaradır.

Səhrələşmə prosesi tədqiq edən bir sıra alimlərin fikrincə, səth örtüyü albedosunun artması kütləvi sürətdə bitki örtüyünün, xüsusi ilə də meşələrin məhv edilməsi, torpaq səthinin pozulması ilə əlaqədardır. Albedonun 10% artması torpaq səthində temperaturun 2,5⁰ artmasına səbəb olur

(V.L.Qayevski). Bu isə radiasiya və istilik balansının dəyişməsinə gətirib çıxarır, nəticədə isə səhrələşmə prosesinin inkişafı üçün şərait yaranır.

D.Yarin müəyyən etmişdir ki, albedonun artması ilə əlaqədar buludluluq və yağıntıların miqdarı azalır, hətta albedonun dəyişməsi nəticəsində bir həftədən sonra yağıntıların miqdarı 40% azalır.

Bunu da qeyd edək ki, albedonun artması torpağın quraqlaşmasına və hətta sıra səhrələşmə olan ərazilərin albedosunun müqayisəsi bunu bir daha sübut edir. (Cədvəl 1) [5]

Aylar

Məntəqələr	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Naxçıvan	0.70	0.63	0.33	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.40
Daşkənd	0.42	0.33	0.21	0.19	0.18	0.19	0.19	0.20	0.22	0.21	0.22	0.44
Səmərqənd	0.45	0.36	0.25	0.35	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Aşkabad	0.33	0.31	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.31

Cədvəldən də aydın olduğu kimi Naxçıvan Muxtar Respublikası və Orta Asiyanın düzənlik ərazilərində yerləşən məntəqələrin illik albedoları təqribən eyni göstəricilərə malik olur. Lakin bu ərazilərdə səhrələşmə prosesinin intensivliyi fərqlidir.

Ərazidə olan meşə və kolluqların məhv edilməsi də albedonun kəmiyyətinin dəyişməsinə böyük təsir göstərir. Belə ki, bitki örtüyünün məhv edilməsi səthin albedosunu artırır, nəticədə iqlim səhrələşməsi baş verir.

Muxtar Respublikada radiasiya balans maksimum yay aylarında, minimum qış aylarında müşahidə edilir. Radiasiyanın miqdarı il boyu düzənlikdən dağlara doğru azalır.

Muxtar Respublikanın kontinentallığı Orta Asiyanın daxili səhra rayonlarına uyğun gəlir.

Ə.C.Əyyubovun (1968) tərtib etdiyi iqlimin kontinentallığı dərəcəsi şkalasına müvafiq olaraq Naxçıvan Muxtar Respublikası ərazisində kəskin (80 kk), çox (61 – 80 kk) və orta kontinentallıq (46 – 60) dərəcələri ayrılmışdır.

Naxçıvan respublikamızın digər rayonlarından öz kontinentallığı və yüksək termik şəraiti ilə kəskin şəkildə fərqlənir. Bu fərqlilik isə zəif bioloji məhsuldarlığa və zəif dayanıqlılığa malik geokomplekslərin formalaşmasına səbəb olmuşdur. Ərazidə olan kəskin aridlik bioloji potensiala mənfi təsir edir və bunlada səhrələşməni sürətləndirir.

Muxtar Respublikanın mürəkkəb geologiyası yağıntılara da birbaşa təsirini göstərir. Ərazidə yüksəkliyə doğru yağıntıların miqdarı artır. (Cədvəl 2) [2]

Cədvəl 2

Qurşaq / H./m.	Arazboyu düzənlik (600–1000 m.)	Alçaq dağlıq (1100–1300 m.)	Orta dağlıq (1500–2000 m.)	Yüksək dağlıq (2100–3900 m.)
İllik yağıntının miqdarı	275 mm	331 mm	536 mm	707 mm

Ərazidə ən az yağıntı Cəhriyə, ən çox yağıntı isə 2400-2600 m-dən yüksək olan ərazilərə düşür. 2600 m-dən yüksəyə doğru qalxdıqca isə yağıntılar yenidən azalır.

Tədqiqatlara əsasən deyə bilərik ki, Naxçıvan Muxtar Respublikasında səhrələşmənin yaranmasına təsir edən ən başlıca amillərdən biri də mümkün buxarlanmadır. Mümkün buxarlanmanın kəmiyyəti düzənlik ərazilərdə daha yüksək, dağlıq ərazilərə qalxdıqca isə azalır. Yağıntıların az olduğu Muxtar Respublikada mümkün buxarlanmanın yüksək kəmiyyəti səhrələşmə riskini daha da artırır. Hətta yay vaxtlarında bəzi ərazilərdə mümkün buxarlanmanın kəmiyyəti yağıntıların miqdarından daha çoxdur ki, bu proses bir başa səhrələşmənin intensivliyini artırır.

Naxçıvan Muxtar Respublikası ərazinin nəmlənmə dərəcəsinə görə də Respublikanın digər ərazilərindən fərqlənir. [1]. Burada nəmlənmə şəquli zonallığa tabedir. Düzənlik ərazilərdə nəmlənmə cuzi nəzərə çarpsa da, yüksək dağlıqlarda bu kəmiyyət artır.

Səhrələşmə prosesinə təsir edən digər bir coğrafi ünsür isə küləkdir. Əsasən də ilin isti dövründə əsas isti

quru küləklər rütubəti azaldır, torpaq və bitki örtüyünün deqredasiyasına səbəb olur, ərazinin səth örtüyünün formalaşmasına mane olur və bununlada səhrələşmə prosesinin intensivliyini artırır. Bu cür küləklərin ən çox müşahidə edildiyi ərazi isə Arazboyu düzənliklərin qərb hissələridir. Qeyd edək ki, bu küləklər ərazidə temperaturun da artmasına səbəb olur.

İqlim və səhrələşmə prosesləri arasında qarşılıqlı əlaqəni bir çox tədqiqatçı alimlər araşdırmış (M.Budıko, K.Vannikov, D.Çarni, V.Kovda, N.Xarin və s.) və təzadlı fikirlər söyləmişdir. Müəyyən edilmişdir ki, iqlimdə baş verən bu dəyişikliklər səhrələşmə prosesinə və ya ümumən arid ərazilərin təbii komplekslərinə öz təsirini göstərir.

Muxtar Respublika ərazisində arid iqlim müşahidə edildiyindən bu ərazilərdə kənd təsərrüfatına yararlı torpaqlar da azlıq təşkil edir. Bu iqlim şəraiti aqrar sahədə də özünü biruzə verir. Əkinçilikdə üstünlük suvarma əkinçiliyidir. Arid iqlimlə əlaqəli olaraq yağıntıların da az olması müşahidə edilir. Bu səbəbdən də suvarma əkinçiliyində belə çətinliklər ortaya çıxır. Araşdırmalar göstərir ki, damla üsulu ilə suvarmaya

Muxtar Respublika ərazisində daha çox üstünlük verilir. Əkinçilikdə üstünlük əvəllər pambıq, son dövrlərdə isə buğda, qarğıdalı, meyvəçilikdə çəyirdəkli meyvələr, üzüm və s. olmuşdur. Heyvandarlıqda isə yay və qış otlaqlarına ehtiyac duyulur. Ərazi arid iqlimdə yerləşdiyinə görə düzən ərazilər qış otlaqları kimi istifadə edilir. Yüksək dağlıqlar isə (Şahbuz, Ordubad və s.) yay otlaqları kimi əlverişlidir. Bundan başqa bu ərazilər GES üçün əlverişlidir.

Nəticə

Elmi məqalədə Naxçıvan Muxtar Respublikasının iqlim şəraiti, bu iqlim şəraitinin təsir etdiyi sahələr tədqiq edilmişdir. Nəticədə Muxtar Respublikanın iqlim şəraitinin kontinental, yəni arid iqlim olduğu vurğulanmışdır. Aridliyi yaradan səbəblər isə, başlıca olaraq Günəş radiasiyasının bu ərazilərə çox düşməsi, buludluluğun az olması səbəbi ilə düz radiasiyanın birbaşa gəlib çatması, dəniz və okeanlardan uzaqlıq, yağıntıların azlığı, isti küləklər, mümkün buxarlanmanın çox olması və s. amillərdir. Bu səbəblərdəndir ki, Naxçıvan Muxtar Respublikası ərazisində səhrələşmə intensiv gedir. Düzən ərazilərdə əsasən də Arazboyu düzənliklərdə bu proses daha güclü gedir. Nisbətən yüksək ərazilərdə və dağlıqlarda isə səhrələşmə prosesi daha zəif gedir. Buna səbəb isə Günəş şüalarının səthə qeyri-bərabər düşməsidir. Səhrələşmə prosesinə təsiri edən bir çox coğrafi amil araşdırılmışdır. Mümkün buxarlanma ilə bağlı

tədqiqatlar aparılmışdır. Mümkün buxarlanmanın kəmiyyətinə fərqli ərazilərdə fərqli rast gəlinmişdir. Buxarlanma düzən ərazilərdə kəmiyyətcə yüksək olduğu halda, dağlıq ərazilərdə bu kəmiyyət azalır.

Yağıntıların miqdarı da bu prosesə güclü təsir edir. Mümkün buxarlanma kimi yağıntılarda düzənlikdən yüksəyə qalxdıqca azalır.

Səhrələşmə prosesinə küləklərin də təsiri böyükdür. İsti və quru küləklər xüsusilə diqqət çəkir. Bu küləklərin müşahidə olunduğu ərazilərdə yağıntıların miqdarı azalır, temperatur isə yüksəlir. Bu isə öz növbəsində təbii geokomplekslərin deqredasiyasına gətirib çıxarır.

Səhrələşmə prosesi aqrar sahədən də yan keçməmişdir. Beləliklə, bu proses həm əkinçiliyə, həm də heyvandarlığa güclü təsir etmişdir.

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LANDSCAPE ECOLOGY

პლასტიკით გარემოს დაბინძურებით მოსალოდნელი შედეგები და გამოსავლის
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EXPECTED CONSEQUENCES OF ENVIRONMENTAL POLLUTION WITH PLASTIC AND POSSIBLE SOLUTIONS

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რეზიუმე

სტატიაში მოცემულია პლასტიკით გარემოს დაბინძურების მასშტაბები, ფორმები, სახეობები და მოსალოდნელი საფრთხეები რომელიც სერიოზულ ზიანს აყენებს ფლორას და ფაუნას, საფრთხეს უქმნის ცხოველების მრავალ სახეობას და ადამიანს. წარმოდგენილია მეორადი პლასტიკით გამოწვეული საფრთხეების თავიდან აცილების გზები, მოყვანილია მეორადი ნედლეულის გამოყენების არსებული გამოცდილება, შესაძლებლობები და პერსპექტივები.

Abstract

The article presents the scale, forms, types and expected dangers of plastic pollution of the environment, which causes serious damage to flora and fauna, poses a threat to many species of animals and humans. Ways to avoid the dangers caused by secondary plastics are presented, and the existing experience, opportunities and prospects for the use of secondary raw materials are presented.

საკვანძო სიტყვები: პლასტიკი. გარემოს დაცვა, პოლიმერული ნაერთები, მეორადი გადამუშავება. სამშენებლო მასალა.

Keywords: plastic. Environmental protection, polymer compounds, secondary recycling. Building material.

თანამედროვე სამყაროში გარემოს პლასტიკით დაბინძურება ერთ-ერთ გლობალურ პრობლემას წარმოადგენს. ყოველდღიურად გარემოში საკმაოდ დიდი რაოდენობით პლასტიკის ნარჩენები ხვდება. ისინი უარყოფითად მოქმედებენ გარემომცველ გარემოზე, ზიანს აყენებენ ცოცხალ ორგანიზმებს და საფრთხეს უქმნიან ადამიანის სიცოცხლეს. მსოფლიოს სხვადასხვა რეგიონებში არსებობს მცდელობები, რათა შემცირდეს პლასტიკის ნაკეთობების გამოყენება, დაინერგოს მისი ნარჩენების გადამუშავება და მათი მეორადი გამოყენება.

პლასტიკის ფართოდ გამოყენება და მისი დიდი რაოდენობის ნარჩენებად ქცევა დაკავშირებულია მის დაბალ ფასთან, ასევე ის კარგი ტარა და შესაფუთი მასალაა, მსუბუქია, ადვილია მისი წარმოება, გამოყენება და რიგი სხვა სამომხმარებლო თვისებები.

2022 წლის მონაცემებით მთელ მსოფლიოში წარმოებულია 400 მლნ. ტონა პლასტიკი.[6] საყურადღებოა რომ ბოლო 30 წლის განმავლობაში პლასტიკის წარმოება 4-ჯერ გაიზარდა.

კვლევების შედეგად, რომელიც ბოლო 20 წლის განმავლობაში იქნა ჩატარებული, დადგენილია რომ მსოფლიო ოკეანეში მოხვედრილი მიკროპლასტიკის 35% წარმოიქმნება სინთეტიკური ქსოვილისგან დამზადებული ტანსაცმლის რეცხვისას, 28% - ავტომობილების საბურავების ცვეთისას, 24% - ქალაქის ჰაერის მტვერში. მოკროპლასტიკი აღმოჩენილია ატმოსფერულ ნალექებში (კერძოდ წვიმის წყალში).

პლასტიკის ნარჩენები შეადგენენ მყარი ნარჩენების 12%-ს.

მსოფლიო ლიდერებს პლასტიკით პლანეტის დაბინძურებაში წარმოადგენენ Coca-Cola-ს, PepsiCo-ს და Nestles-ს წარმოებები.

პლასტიკის დაშლის საშუალო დრო. რომლებიც სხვადასხვა ტექნოლოგიებით არის დამზადებული, ასეული წლებით განისაზღვრება, ამიტომაც რომ პოლიეთილენის პაკეტები, რომლებსაც ადამიანები ყოველდღიურად გამოიყენებენ, გარემოში საკმაოდ დიდი რაოდენობით რჩება.

ძირითადი საშიშროება ნიადაგში და მიწის წიაღში მოხვედრილ პლასტიკთან არის დაკავშირებული, რადგან ის შეიძლება მცირე ზომის ნაწილაკებად დაიშალოს და მისი წარმოებისას დამატებული სხვადასხვა ქიმიური ნივთიერებები გამოყოს გარემოში, კერძოდ ბისფენოლ A, რომელიც მცირე კონცენტრაციებითაც კი წარმოადგენს პოტენციურ საფრთხეს ცოცხალი ორგანიზმებისათვის.

ასევე საყურადღებოა ბიომლადი პლასტიკიც, რომელიც დაშლის შედეგად გამოყოფს მეთანს - ერთ ერთ სათბურის აირს, რომელსაც გლობალური დათბობის პროცესში მნიშვნელოვანი ადგილი უკავია.

საუკუნის მეორე ნახევარში პოლიმერული ნაერთების და პლასტმასის წარმოების ზრდასთან ერთად სწრაფად განვითარდა თერმოპლასტიკური ტექნოლოგიები.

დაიწყო სხვადასხვა სახის ნივთიერებებისა და პლასტმასისაგან იაფი ნივთების წარმოება, რომლებიც ანაცვლებენ მასობრივი წარმოების ტრადიციულ მასალებს. იმ დროისათვის პლასტმასის წლიური მოხმარება ერთ სულ მოსახლეზე დასავლეთ ევროპაში იყო 92 კგ., 13 კგ - აღმოსავლეთ ევროპაში, 130 კგ.-ჩრდილოეთ ამერიკაში, 19 კგ.-ლათინურ ამერიკაში, 80 კგ.-იაპონიაში, 13 კგ.-სამხრეთ-აღმოსავლეთ აზიაში და 8 კგ.- ახლო აღმოსავლეთსა და აფრიკაში.

ამჟამად კი ეს მონაცემები ბევრად უფრო მაღალია.

ზღვებისა და ოკეანეების პლასტიკით დაბინძურება საფრთხეს უქმნის ზღვებისა და ოკეანეების ეკოსისტემებს, ბიომრავალფეროვნებას, ველურ ცხოველებს და იწვევს სოციალურ და ესთეტიკურ პრობლემებს, უარყოფით გავლენას ახდენს ეკონომიკაზე, განსაკუთრებით მეთევზეობაზე, აკვაკულტურაზე, რეკრიაციასა და მემკვიდრეობით ღირებულებებზე.

ზღვაში არსებული მყარი ნარჩენების მთავარი მახასიათებელია ის, რომ ისინი ხმელეთიდან ხვდებიან ზღვაში ე.წ. ზღვის წყაროებიდან (ზღვის ტრანსპორტი და თევზჭერა), საყურადღებოა გადაგებული, დაკარგული ან მიტოვებული სათევზაო აღჭურვილობა, განსაკუთრებით სათევზაო ბადეები, რომლებიც სერიოზულ საფრთხეს უქმნიან თევზების, ზღვის ძუძუმწოვრების,

კუებისა და ფრინველების სიცოცხლესა და ჯანმრთელობას.

პლასტიკის გზა მსოფლიო ოკეანისკენ იწყება ხმელეთიდან, და არა აუცილებლად პლიაჟიდან და სანაპიროდან. მდინარეები ჩაედინება ზღვებში, ასევე საკანალიზაციო სისტემები ამთავრებენ თავის გზას ზღვებში.

მიუხედავად მათი ხანგრძლივი არსებობისა და გამძლეობისა, ტალღების და ქარის მექანიკური ფაქტორებისა და მზის ულტრაიისფერი გამოსხივების ზეგავლენით, პლასტიკური საგნები ხდებიან ძალიან მყიფე და მსხვრევადი. ისინი იმსხვრევიან პატარ-პატარა ნაწილებად, რომლებსაც ეწოდება მიკროპლასტიკები.

მიკროპლასტიკები არიან პატარა პლასტმასები, 5 მმ-ზე ნაკლები დიამეტრით, რომლებიც ძირითადად იყოფიან ორ ქვეკატეგორიად: პირველადი

მიკროპლასტიკები წარმოებულია მრავალ ისეთ პროდუქტში გამოსაყენებლად როგორიც არის: კბილის პასტა, პირადი ჰიგიენის კრემები, კოსმეტიკა და სხვა. მეორადი მიკროპლასტიკები მიიღება დიდი პლასტიკური ნივთების ფრაგმენტაციის ანუ დამსხვრევის შედეგად. მიკროპლასტიკი ოკეანეში არსებული პლასტიკის მნიშვნელოვან ნაწილს წარმოადგენს. ის საფრთხეს უქმნის ოკეანის ცხოვრებას, ეკოსისტემებს და ადამიანის ჯანმრთელობას.

პლასტიკური ნაწილაკების არსებობა მსოფლიო ოკეანეში კარგადაა არის ცნობილი, მაგრამ ამ ბოლო წლებში ჩატარებულმა კვლევებმა აჩვენა, რომ პლასტიკის ნაწილაკები და ძაფები არის ყველგან, წვიმის წყალშიც კი, პლასტიკის წვიმა მოდის პრაქტიკულად ყველგან. ადამიანები მისდაუნებურად მოიხმარს მიკროპლასტიკის საშუალოდ 200 ერთეულს ყოველ კვირა ან 21მ გრ. ყოველ თვე, რაც წელიწადში შეადგენს 50 ათას ერთეულს! ორჯერ მეტი პლასტიკი შთაინთქმება სასმელი წყლის საშუალებით, მიკროპლასტიკის სხვა წყაროებია ზღვის პროდუქტები, ზღვის მარილი.

ჯერ ისევ უცნობია პლასტიკის ის რაოდენობა, რომელსაც შეუძლია ზიანი მიაყენოს ადამიანის ჯანმრთელობას!

ის გარემოება განსაკუთრებით საყურადღებოა, რომ სხვადასხვა ტიპის ნარჩენები, რომლებიც ხვდებიან მდინარეებში, ზღვებსა და ოკეანეებში, განსაკუთრებულ ზიანს აყენებენ ბიომრავალფეროვნებას. უმეტეს შემთხვევაში არიან მიზეზი ცხოველების გახლართვისა და დაჭერისა სხვადასხვა საგნებში, რაც იწვევს მათი კიდურების ფუნქციონირების უნარის დაკარგვას, ხრჩობას და საბოლოოდ სიკვდილს.

რაც შეეხება ჭარბტენიან ტერიტორიებს, აქაც ე.წ. „თევზის მოწყობილობები“ - დაკარგული ან გადაგდებული ნიჟარითა და კაუჭებით აღჭურვილი ანკესები, წარმოადგენენ სერიოზულ საფრთხეს. მათ ხშირად ყლაპავენ გედები და სხვა ფრინველები, რომლებიც წყალში ეძებენ საკვებს, რაც იწვევს მათ ორგანიზმში ფარულ სისხლდენას. ასევე მოწამვლას, რაც საბოლოოდ მთავრდება მათი სიკვდილით.

მსოფლიო ოკეანეში შემოტანილი პლასტიკის 90%-ის ძირითადი წყაროა 10 მდინარე: აზიიდან მდინარეები: იანცზი, ინდი, ხუანხე, ამური, მეკონგი, განგა, ჩჟუცზიანი და ხაიხე; აფრიკიდან: ნიგერი და ნილოსი.

მცენიერი ჯემბეკის შეფასებით ოკეანეში მოხვედრილი პლასტიკის ნარჩენების ნახევარზე მეტი აზიის ხუთ დიდ ქვეყანაზე მოდის, ესენია: ჩინეთი, ინდონეზია, ფილიპინები, ვიეტნამი და შრი-ლანკა.

გ ა ე რ -ს ბოლო ანგარიშში აღნიშნულია, რომ ოკეანეში მცურავი პლასტიკის 70% დაკავშირებულია თევზჭერასთან. ზღვებისა და ოკეანური წყლების დაბინძურება პლასტიკით წარმოადგენს სერიოზულ საფრთხეს ზღვის ძუძუმწოვრებისათვის [33]. ზღვის კუს კუჭში აღმოჩენილი იქნა პლასტიკის ნარჩენები (მცირე ზომის ნაწილაკები) რომლებიც იწვევენ მათ შიშშილს, ის მას ვერ ინელებს და ილუპება. არანაკლებ ცუდ მდგომარეობაში იმყოფებიან თოლიებიც, ჩრდილოეთ ზღვის თოლიების კუჭში აღმოჩენილ იქნა პლასტიკის ნარჩენები [34].

პლასტიკი ფართოდ გამოიყენება კვების პროდუქტების და ფარმაცევტული პრეპარატების შესაფუთად. ზოგიერთი სპეციალისტი გამოთქვამს უნდობლობას თუ რამდენად უსაფრთხოა ისინი ადამიანის ჯანმრთელობისათვის, რადგან მოხმარების შემდეგ შესაფუთი მასალა მალე პლასტიკის ნარჩენებად იქცევა.

ასევე გასათვალისწინებელია, რომ პლასტიკის ნარჩენები „ნაგავი“ ვიზუალურად და ესთეტიკურადაც გავლენას ახდენს გარემოზე.

პლასტიკიდან დამზადებული საქონელი, იმ შემთხვევაში ითვლება უსაფრთხოდ, თუ მას გააჩნია სერტიფიკატი მწარმოებელი ფირმიდან. განსაკუთრებით მკაცრი მოთხოვნები წარედგინება სამედიცინო, კვების პროდუქტების შესაფუთი მასალების, საბავშვო ტანსაცმელის და სათამაშოების მწარმოებელ ორგანიზაციებს.

ცივილიზაცია პლასტმასზე როგორც უამრავი მიმართულებით გამოყენებად ეფექტურ ნედლეულზე უარს არ და ვერ იტყვის,

არსებული სიტუაციიდან გამოსავალი მის მეორად გამოყენებით შეიძლება იქნას მოძიებული. ბოლო ათეული წლებია ამ მიმართულებით სხვადასხვა ქვეყნებში სერიოზული ნაბიჯები იქნა გადადგმული. პლასტმას ჰოლანდიაში და არა მარტო იქ აქტიურად იყენებენ ასფალტის წარმოებაში, მიღებული იქნა ახალი სახეობის ასფალტი, რომელიც სრულად პასუხობს საავტომობილო გზაზე უსაფრთხოდ გადაადგიოების მიმართ წაყენებულ მოთხოვნებს. ასფალტის წარმოებისას ბიტუმი როგორც მასალის შემკვრელი ნედლეული მეორადი პლასტმასით იქნა ჩანაცვლებული, ამით შემცირდა მიღებად რეჟიმში მყოფი მასალის წარმოებისას გარემოზე ნეგატიური ზემოქმედების მასშტაბები, და პლასტმასის შესაბამისი მოცულობები ნაგვასაყრელზე გატანის ნაცვლად მეორად რეჟიმში იქნა გამოყენებული.

ნავთობპროდუქტის ახალზელანდიელი გამომგონებელი და ინჟინერი პიტერ ლუისი გაერთიანდა ByFusion აპარატის უკან მყოფ ადამიანებთან, რათა ეს პლასტმასის აგური რეალობად აქციოს. ByFusion მანქანა კონფიგურირებულია იმისათვის, რომ აწარმოოს RePlast ბლოკები ჩვეულებრივი ბეტონის ბლოკების ზომითა და ზომებით და შეიძლება გამოყენებულ იქნას ინფრასტრუქტურის, განვითარებისა და სამშენებლო პროექტების ფართო სპექტრში. დამატებითი ბონუსი არის ის, რომ მასალები უფრო მტკიცე და მსუბუქია ვიდრე ბეტონი, რაც მათ ტრანსპორტირებას და დაყრას აადვილებს. გუნდმა თავი მიუძღვნა დაბალშემოსავლიანი საცხოვრებლის შექმნას მთელს მსოფლიოში და ისინი არ არიან ერთადერთი. კომპანია Affresol აშენებს სამოთახიან სახლებს აბაზანით, სამზარეულოთი და სანტექნიკით მთლიანად გადამუშავებული ნარჩენების პლასტმასისგან დამზადებული ჩარჩოებით, როგორცაა წყლის ბოთლები, ეს ყველაფერი მხოლოდ დაახლოებით \$42,000 ღირს. გამოყენებული პლასტმასი თითქმის ოთხჯერ უფრო ძლიერია ვიდრე ბეტონი და ორჯერ კარგად იზოლირებს სახლს, რაც შესაძლებელს გახდის მათი გათბობის გადასახადების განახევრებას. სახლები ასევე ხანძარსაწინააღმდეგოა, ქარიშხალი და ქარი და ბუნებრივად წყალგაუმტარია.

შპს Miniwiz Sustainable Energy არის კიდევ ერთი კომპანია, რომელიც იყენებს პლასტმასს, როგორც ძირითად მასალას სახლების ასაშენებლად. შენობების კედლები დამზადებულია მხოლოდ პლასტმასის ბოთლებისაგან, რომლებიც ერთმანეთს ერგება, როგორც ლეგოს ნაჭრები. მრავალკუთხა

ბოთლებს უწოდებენ Polli-Bricks-ს, რომლებიც შენობებს კონსტრუქციულად ხდიან და უძლებენ მიწისძვრებსა და ტაიფუნებს, რაც ამ სახლებს იდეალურს ხდის ბუნებრივი კატასტროფებისადმი მიდრეკილი ადგილებისთვის. ასევე ამბობენ, რომ პოლი აგურის სახლები ეკოლოგიურად სუფთა და შედარებით იაფია ასაშენებლად. ეს კომპანიები უზრუნველყოფენ საცხოვრებლის ხარჯების ეფექტურ გადაწყვეტილებებს გარემოზე დადებით გავლენას. რამდენადაც პლასტიკური ხდება უფრო და უფრო დიდი პრობლემა, ჩვენ ყველანი ერთად შევიკრიბებით ეფექტური გადაწყვეტილებების შესაქმნელად და მსგავსი გადაწყვეტილებების მხარდასაჭერად, რაც ხელს შეუწყობს უკეთესი ხვალისდელი დღის შექმნას ყველასთვის. ინდოეთში დაფუძნებულმა კომპანიამ Rhino Machines-მა გამოუშვა "სილიკას პლასტმასის ბლოკი" - მდგრადი სამშენებლო აგური, რომელიც დამზადებულია სამსხმელო მტვრის/ქვიშის ნარჩენებისგან (80%) და შერეული პლასტმასის ნარჩენებისგან (20%). "სილიკა-პლასტმასის ბლოკი" ან SPB ცდილობს დაუპირისპირდეს მასიური მტვრის ნარჩენებს და საერთო დაბინძურების წარმოებას ინდოეთში, რამაც გამოიწვია სერიოზული გარემოსდაცვითი საფრთხე. პროექტი დასრულდა r+d ლაბორატორიებთან თანამშრომლობით; არქიტექტურული ფორმის r+d სტუდიის კვლევითი ფრთა „სილიკა-პლასტმასის ბლოკის“ პროექტი დაიწყო ქვიშის სამელიორაციო ქარხნიდან ნულოვანი ნარჩენების წარმოების მკაფიო მანდატით, მარტორქის მანქანების სამსხმელო ქარხანაში. საწყის ეტაპებზე ცდები ჩატარდა სამსხმელო მტვრის გამოყენებით ცემენტით შეკრულ მფრინავ ნაცარ აგურებში (7-10% ნარჩენების გადამუშავება) და თიხის აგურებში (15% ნარჩენების გადამუშავება). ეს ექსპერიმენტი ასევე მოითხოვდა ბუნებრივი მარაგების გამოყენებას, როგორცაა ცემენტი, ნაყოფიერი ნიადაგი და წყალი. პროცესში მოხმარებული ბუნებრივი რესურსების რაოდენობა არ იყო გამართლებული იმ ნარჩენებით, რომლის გადამუშავებაც შეძლო. ამ ცდებმა განაპირობა მეტი კვლევა შიდა R&D ჯგუფის მიერ, რის შედეგადაც შესაძლებელი გახდა ქვიშის / სამსხმელო მტვრის პლასტმასის შეერთება. პლასტმასის, როგორც დამაკავშირებელი აგენტის გამოყენებით, წყლის საჭიროება შერევის დროს და შემდგომ გამაგრების დროს მთლიანად აღმოიფხვრება. ბლოკები შეიძლება გამოყენებულ იქნას პირდაპირ ჩამოსხმის პროცესიდან გაგრილების შემდეგ. აღმოჩნდა, რომ SPB-ებს აქვთ 2,5-ჯერ მეტი სიმტკიცე ვიდრე ჩვეულებრივი წითელი თიხის აგური,

ხოლო მოხმარებისთვის მათ სჭირდებათ სამსხმელო მტვრის დაახლოებით 70-დან 80%-მდე ბუნებრივი რესურსების 80%-ით ნაკლები გამოყენების შემთხვევაში. შემდგომი ტესტირებისა და განვითარებით, მომზადდა უფრო ახალი ყალიბები, რათა გამოსცადონ ისინი, როგორც პავერის ბლოკები და შედეგები წარმატებული იყო. 4 თვის განმავლობაში, სუფთა პლასტმასის უზრუნველსაყოფად სხვადასხვა ინდუსტრიებს, როგორცაა საავადმყოფოები, საზოგადოებები, კერძო პირები, სოციალური ორგანიზაციები და ადგილობრივი მუნიციპალური კორპორაციები მიუახლოვდნენ. სულ შეგროვდა ექვსი ტონა პლასტმასის ნარჩენი და თექვსმეტი ტონა მტვერი და ქვიშა სამსხმელო ინდუსტრიიდან, რომლებიც მზად იყო გადასამუშავებლად. ვინაიდან SPB მზადდება ნარჩენებისგან, წარმოების ღირებულება ადვილად შეუძლია კონკურენცია გაუწიოს ჩვეულებრივ ხელმისაწვდომ წითელ თიხის აგურს ან CMU-ს (ბეტონის ქვის). Rhino Machines ახლა ემზადება ეკოსისტემური გადაწყვეტისთვის, რათა სამსხმელო ქარხნებმა განავითარონ და გაავრცელონ SPB-ები თავიანთი ზემოქმედების ზონებში CSR-ის მეშვეობით (კორპორატიული სოციალური პასუხისმგებლობა - ინდოეთის მთავრობის ინიციატივა ბიზნესისთვის ფილანტროპული მიზნებისთვის და უკან დაბრუნება საზოგადოებას). SPB-ები შეიძლება გამოყენებულ იქნას კედლების, ტუალეტების, სასკოლო კამპუსების, ჯანმრთელობის კლინიკების, მოსაპირკეთებელი გზების ასაშენებლად და ა.შ. პოლანდიური სტარტაპი Plasticiet მიზნად ისახავს შექმნას "რაც ღირებული" რეციკლირებული პლასტმასისგან ინტერიერისა და ავეჯის დიზაინში გამოსაყენებლად. ნიდერლანდების გადამამუშავებელ კომპანიებთან თანამშრომლობით შეგროვებული და დამუშავებული რეციკლირებული პლასტმასის გამოყენებით, Plasticiet აწარმოებს ფურცელ-პლასტმასის მასალებს, რომლებიც გარეგნულად ჰგავს ხელოვნურ ქვის კომპოზიტებს, როგორცაა ტერაზო. ჩვენ გვინდა შევქმნათ რაც ღირებული, რომელიც გაგრძელდება და წარმოიქმნება ადგილობრივი ნარჩენების წყაროდან, - თქვა დუეტმა. "აი, სადაც გაჩნდა იდეა, რომ წარმოექმნათ ფურცლები, რომლებიც შეიძლება გამოყენებულ იქნას სამშენებლო მასალად ყველა სახის აპლიკაციისთვის." მეორადი პლასტმასის გამოყენებით დამზადებული სამშენებლო მასალები სულ უფრო პოპულარული ხდება და ფართე გამოყენებას ნახულობს განსაკუთრებით ენერგო

ეფექტური და გარემოს დაცვის გათვალისწინებით შემუშავებულ რეგულაციების მოთხოვნების გათვალისწინებით. უნივერსიტეტში ჩვენ მიერ მიმდინარეობს კვლევები მშენებლობაში პლასტის მეორად გამოყენების ოპტიმალური ვარიანტის მოძიების მიზნით. პირველადი კვლევების მონაჩემნის ანალიზის საფუძველზე ცხადი ხდება რომ მიღებული სამშენებლო მასალა ხასიათდება რიგი უპირატესობებით: გაცილებით მსუბუქია ანალოგებთან შედარებით. მისი თბოგამტარობისა და სითბოს გადაცემის კოეფიციენტები შესაბამის რეგულაციებით გათვალისწინებულ ფარგლებშია მოქცეული. სიმტკიცე სრულად პასუხობს მასალის მიმართ წაყენებულ მოთხოვნებს.

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NORMAL AND PATHOLOGICAL PHYSIOLOGY

ПАТОГЕНЕТИЧНИЙ ЗВ'ЯЗОК ТОКСИГЕННИХ ШТАМІВ ХЕЛІКОБАКТЕРНОЇ ІНФЕКЦІЇ НА РОЗВИТОК ЦУКРОВОГО ДІАБЕТУ ТИПУ 2. (ОГЛЯД ЛІТЕРАТУРИ)

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PATHOGENETIC RELATIONSHIP OF TOXIGENIC STRAINS OF HELICOBACTERI INFECTION TO THE DEVELOPMENT OF TYPE 2 DIABETES (LITERATURE REVIEW)

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Анотація

Продукція токсинів VacA (50-65%) та CagA є механізмом патогенної дії *H.pylori* (HP.). Відомо, саме токсигенні штами впливають на порушення роботи підшлункової залози, порушення серцево-судинної системи. Подальший такий розвиток призводить до розвитку цукрового діабету типу 2 з ускладненнями як артеріальна гіпертензія, мікроангіопатії, макроангіопатії, ураження нирок (пієлонефрит), шлункові кровотечі, тощо. Досліджено і патогенетичний зв'язок *H. pylori* із макроангіопатією, нейропатією та мікроальбумінурією, який пояснюється імуніопосередкованим ураженням ендотелію, вираженою системною запальною відповіддю, що є початковим етапом розвитку ЦД.

З огляду на високу поширеність захворювання, ускладнений перебіг та можливість виникнення рецидивів пептична виразка дванадцятипалої кишки у поєднанні із цукровим діабетом типу 2 є важливою медико-соціальною проблемою. Досягнення медицини за останні десятиліття дають можливість впровадження в практику нових класів лікарських засобів, що змінили стратегію лікування пептичної виразки дванадцятипалої кишки з урахуванням наявності супутньої патології та токсигенності штамів *H. pylori* і сприяють покращенню якості життя хворого.

Abstract

The production of VacA (50-65%) and CagA toxins is the mechanism of pathogenic action of *H.pylori* (HP.). It is known that toxigenic strains affect pancreatic dysfunction and cardiovascular system disorders. Further such development leads to the development of type 2 diabetes with complications such as hypertension, microangiopathy, macroangiopathy, kidney damage (pyelonephritis), gastric bleeding, etc. The pathogenetic connection of *H. pylori* with macroangiopathy, neuropathy and microalbuminuria, which is explained by immune-mediated damage to the endothelium, expressed by a systemic inflammatory response, which is the initial stage of the development of diabetes, was also investigated.

Due to the high prevalence of the disease, the complicated course and the possibility of relapses, peptic ulcer of the duodenum in combination with type 2 diabetes is an important medical and social problem. Advances in medicine over the last decades make it possible to introduce new classes of drugs into practice, which have changed the strategy of treating peptic ulcer of the duodenum, taking into account the presence of concomitant pathology and the toxigenicity of *H. pylori* strains and contribute to improving the patient's quality of life.

Ключові слова: Цукровий діабет, пептична виразка дванадцятипалої кишки, патогенез.

Keywords: Diabetes, peptic ulcer of the duodenum, pathogenesis.

Introduction. The production of VacA (50-65%) and CagA toxins is the mechanism of pathogenic action of *H. pylori* (HP.). One of the pathogenetic links is the effect of VacA, which can bind to receptors (RPTP α , RPTP β) in epithelial cells [1,2], thus ensuring the interaction of the strain with human kidney tumor cells and adenocarcinoma cells. [3,5]. This makes it possible to interact with gastric carcinoma cells [4,6]. By increasing the sensitivity of RPTP β receptors in some cell lines, which increases the toxicity of VacA [7]. Absence of the RPTP β receptor increases resistance to mucosal ulceration (MU) caused by the action of the toxigenic VacA strain [5,8]. The interaction of VacA with the receptors of the functional lymphocyte antigen of the first type increases the expression of leukocytes [24]. The presence of many receptors for the vacA gene can determine the diversity of its effect on CO [5, 21]. The toxin VacA, which is a "conductor" for the cytotoxin-associated protein CagA, has two informational regions (signal - (s, signal, allelic variants - s1 and s2), middle (m, middle, m1 or m2)), the combination of which leads to the formation of membrane pores with the release of chlorine ions, inhibition of T-lymphocyte activity and the occurrence of vacuolar degeneration of epithelial cells, which is the cause apoptosis [7,8,9].

According to the research of N. Guicelik et al. *H. pylori* infection was established in 75.6% of patients with T2DM [11], the increased frequency of which is explained by the development of microangiopathy of SOS, which creates favorable conditions for the survival of the microorganism [10,12]. However, N.B. Gubergritz established that the frequency of *H. pylori* infection in combination with pancreatitis (86.5%) and without it (76.7%) did not differ [22]. Vacuolizing cytotoxin, which is capable of causing pancreatotoxic effects, inhibits the exocrine function of the pancreas, and *H. pylori* infection, which reduces the synthesis and release of somatostatin (which normally inhibits gastrin production and pancreatic secretion) from D-cells of the stomach, leads to an increase in the synthesis and release of gastrin [13,15,16]. This is accompanied by a decrease in the antral density of D cells, which returns to normal after eradication [14]. The pathogenetic connection of *H. pylori* with macroangiopathy, neuropathy, and microalbuminuria was also investigated, which is explained by immune-mediated damage to the endothelium, a pronounced systemic inflammatory response, which is the initial stage of the development of diabetes [10, 12, 17].

The purpose of the study. To assess the pathogenetic relationship between the impact of toxigenic strains of *Helicobacter* infection and the development of type 2 diabetes.

Research materials and methods. Study of the literature and generalization of the purpose of the research. Review of articles with diseases that are infected with *Helicobacter* infection, diseases of the pancreas, diseases of cardiovascular pathology.

Research results. A certain group of pathogens associated with the rapid progression of insulin resistance (IR) and hyperinsulinemia (GI) has been identified. They include members of the Herpesviridae family (in particular CMV, HSV-1, EBV), Chlamydia Pneumoniae, *Helicobacter pylori* (N. *pylori*),

Porphyromonas gingivalis [4,6,7,24,30]. Endothelial damage is known to occur as a result of direct exposure to *H. pylori* endotoxins and stimulation of systemic and local inflammation [17, 18], the ways of implementing the effects of *H. pylori* infection on the cardiovascular and endocrine systems have not been finally clarified [3, 19].

In recent years, it has been proven that there are 2 types of CagA, which differ in the sequence of amino acids: ABC type (Western) and ABD type (East Asian). AVD-type CagA binds to the SHP-2 site, acts more deeply on the epithelium and leads to severe inflammation and atrophy of the OSH [3, 11]. In Japan, ABD type CagA is found in almost all gastric cancer patients [13, 20], and in Western Europe ABC type CagA dominates, which is the cause of the development of PVDPK (90%) [11, 21].

The ability to directly damage the epithelium of the gastric mucosa is one of the characteristics of *H. pylori*, which have CagA - and VacA - phenotypes and, as a result, show the greatest cytolytic activity. The presence of the *Helicobacter pylori* *agA* gene leads to systemic inflammation due to the activation of lipid peroxidation processes and the development of metabolic intoxication [6,7,10,19,22] with a violation of the hemostasis system [28, 30], subsequently leading to the development of atherosclerosis (AS) and hypertension [23, 24], and, not excluded, and T2DM [22].

The role of NO in the development of endothelial dysfunction, which is one of the key links in the pathogenesis of T2DM, is currently proven and unquestionable [25,26,29].

NO plays an integral role as a bioregulator in the gastrointestinal tract (GI), which regulates gastric secretion and motility and plays a role in protecting the gastric mucosa from aggression factors [5, 27]. NO is one of the sources of gastrointestinal tract, namely in epithelial cells, vascular endothelium, smooth muscles, etc. During the inflammatory process of OSH and DPK, gastric secretion increases, gastric motility increases, hyperemia is observed, which indicates the presence of NO in glandular cells and vessels. A decrease in the activity of NO in all structural elements of the stomach in the case of healing of an ulcer defect indicates its role in the processes of ulcerogenesis [8, 9, 28].

In turn, ET-1 is a powerful vasoconstrictor peptide that regulates angiogenesis of vessels and, being formed under the influence of many factors (adrenaline, vasopressin), is secreted inside the vascular wall, where specific receptors are located [4,9]. It, as well as NO, plays the role of a bioregulator of the digestive system, the concentration of which in the blood plasma increases when a vessel is damaged, which is associated with an increase in its release [3, 14, 22, 23].

The combination of genotypes s1m1, s1m2, s2m1 and s2m2 determines the level of pathogenicity [5,7,25]. The s1m2 sequence encodes a signaling protein (p33), improving penetration into the epitheliocyte membrane. The middle section of DNA is responsible for the synthesis of the p58 receptor domain, and cells with the m1 genotype are able to interact with a wider range of epitheliocytes than those with the m2 genotype. This explains the high vacuolating activity of s1/m1 genotypes, moderate degree of vacuolation in the

s1/m2 genotype and its absence in the s2/m2 genotype [5, 18, 28]. The intermediate i region, which is between the s and m regions, is a marker of disease severity [22, 27], and the s1m1 genotype is considered the 32 most associated with high cytotoxicity and disease severity [16]. Strains containing a combination of s1, i1, m1 alleles are associated with the most severe diseases [15]. This relationship can be realized due to the increased ability to form anion channels, vacuolating activity and wide cellular tropism of s1/i1/m1 genotypes [17, 26]. Since vacA s1/m1 is closely associated with the cagA-positive genotype, this factor cannot be considered separately as a marker of disease severity [15]. In turn, the pathogenicity island of Cag (Cag RAI) HP, which encodes up to 27 genes, having effector proteins, penetrate through the formed pores into the epithelial cells of the host [6, 24], interacting directly with the regulators of cell polarity. It is they who affect the process of mitosis, leading to disruption of the phases of the mitotic cycle (G1 and G2) and the appearance of polyploid cells [7,9]. As a result of the above, the intracellular signaling system SHP-2 is stimulated with the production of pro-inflammatory chemokines IL-8, IL-6, activating the processes of migration of neutrophils into the CSF, contributing to the activation, etc.

The ability to directly damage the epithelium of the gastric mucosa is one of the characteristics of *H. pylori*, which have CagA - and VacA - phenotypes and, as a result, show the greatest cytolytic activity. And in the presence of the gene CarA, *Helicobacter pylori* also affects the processes of systemic inflammation due to the activation of lipid peroxide oxidation processes and due to the development of metabolic intoxication [6, 7, 10, 19, 22], disruption of the hemostasis system [3, 28], leading to the development of atherosclerosis in the future (AS) and hypertension [29], and, not excluded, and T2DM [20]. The obtained data on the influence of *H. pylori* infection on the course of the atherosclerotic process are focused on several aspects: epidemiological association, pathophysiological mechanisms, and the results of eradication therapy [6,7]. The connection between HR seropositivity and the course of the atherosclerotic process has been proven in the presence of sagA [11, 26, 28]. One of the most immunogenic antigens of HR is its HSP, which belongs to the family of bacterial Gro-EL proteins and has wide cross-reactivity both with other bacterial Gro-EL (in particular, mycobacterial) and with human HSP65 [5, 9, 15, 17]. This fact is of considerable importance, since the possibility of AS induction by HSP65 immunization [17, 27] and the level of antibodies to HSP65, which correlates with the degree of risk of vascular events [28] and can react with antigens of the atherosclerotic vascular wall [15], have been proven.], which is also an intermediate link between *H. pylori* infection and the subsequent development of cardiovascular pathology [18]. Another direction of research within the scope of the search for possible mechanisms of *H. pylori* infection interference in the course of the atherosclerotic process is to identify the effect of *Helicobacter* infection on the exchange of biologically active substances, in particular, on the synthesis of nitrogen monoxide (NO) in the endothelium, which is a regulator of hemostasis and vascular tone [11, 18, 27]. The relationship between HP infection and

pancreatic diseases remains unclear. The effect of this microorganism on the development of pancreatitis and diabetes mellitus 2 has been revealed, but studies on the spread of *helicobacter* infection in patients with diabetes mellitus are ambiguous.

Conclusion. Due to the high prevalence of the disease, the complicated course and the possibility of relapses, peptic ulcer of the duodenum in combination with type 2 diabetes is an important medical and social problem. Advances in medicine over the last decades make it possible to introduce new classes of drugs into practice, which have changed the strategy of treating peptic ulcer of the duodenum, taking into account the presence of concomitant pathology and the toxigenicity of *H. pylori* strains and contribute to improving the patient's quality of life.

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**ВПЛИВ ФІТОЗАСОБІВ (ЛИСТЯ І СІК АЛОЕ ТА БЕРЕЗОВИХ БРУНЬОК) НА СТАН
СЛИЗОВОЇ ОБОЛОНКИ ШЛУНКА ТА ДВНАДЦЯТИПАЛОЇ КИШКИ У ХВОРИХ НА
ПЕПТИЧНУ ВИРАЗКУ З АРТЕРІАЛЬНОЮ ГІПЕРТЕНЗІЄЮ І ЦУКРОВИМ ДІАБЕТОМ ТИПУ 2**

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**THE INFLUENCE OF PHYTOPRODUCTS (LEAVES AND JUICE OF ALOE AND BIRCH BURDS)
ON THE STATE OF THE MUCOUS MEMBRANE OF THE STOMACH AND DUODENUM IN
PATIENTS WITH PEPTIC ULCER WITH ARTERIAL HYPERTENSION AND TYPE 2 DIABETES**

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Анотація

У статті висвітлено лікувальні властивості листя і соку алое, що містять у своєму складі вітаміни, ферменти, фітонциди, смолисті речовини, сліди ефірних масел, а також антраглікозиди (алоїн, наталоїн, рабарберон, гомонаталоїн, емодин). У складі листя алое виявлено високий вміст кальцію, барію, селену, стронцію, літію і бору. **В березових бруньках** містяться ефірні масла, смолисті речовини, флавоноїди, сапоніни, сесквітерпенові лактони, фітонциди, вітаміни, аскорбінові кислоти, каротин, флавоноїди, нікотинову кислоту, дубильні речовини, глікозиди. **А також** - мінеральні речовини (натрій, магній, алюміній, залізо, стронцій, кремній, титан, барій, марганець, нікель, кальцій, мідь, цирконій, калій, фосфор.

Висновок. Оскільки алое та березові бруньки мають великий спектр лікувальних властивостей, а саме, жовчогінну, протизапальну, антисептичну, протиопікову, та одночасно посилює секрецію травних залоз, покращує апетит і травлення, антибактеріальна властивість відносно стафілококів, стрептококів, дифтерійної, черевнотифозної і дизентерійної паличок, дозволяє встановити їх вплив на перебіг пептичної виразки шлунка та дванадцятипалої кишки у поєднанні з артеріальною гіпертензією та цукровим діабетом типу 2.

Abstract

The article highlights the healing properties of aloe leaves and juice, which contain vitamins, enzymes, phytoncides, resinous substances, traces of essential oils, as well as anthraglycosides (aloin, nataloin, rhubarberon, homonataloin, emodin). A high content of calcium, barium, selenium, strontium, lithium and boron was found in the composition of aloe leaves. Birch buds contain essential oils, resinous substances, flavonoids, saponins, sesquiterpene lactones, phytoncides, vitamins, ascorbic acids, carotene, flavonoids, nicotinic acid, tannins, glycosides. And also - minerals (sodium, magnesium, aluminum, iron, strontium, silicon, titanium, barium, manganese, nickel, calcium, copper, zirconium, potassium, phosphorus).

Conclusion. Since aloe and birch buds have a wide range of medicinal properties, namely, choleric, anti-inflammatory, antiseptic, anti-burn, and at the same time enhance the secretion of digestive glands, improve appetite and digestion, antibacterial property against staphylococci, streptococci, diphtheria, typhoid and dysentery bacilli, allows to establish their effect on the course of peptic ulcer of the stomach and of the duodenum in combination with arterial hypertension and type 2 diabetes.

Ключові слова: алое, березові бруньки, пептична виразка, шлунок, дванадцятипала кишка, артеріальна гіпертензія, цукровий діабет.

Keywords: aloe, birch buds, peptic ulcer, stomach, duodenum, arterial hypertension, diabetes.

Relevance of the topic. As you know, peptic ulcer (PE) is one of the most common diseases in modern gastroenterology. [1,3]. And the influence of H. Pylori, as the main pathogen, has been proven long ago and

convincingly. However, over time, there have been reports about the immune defense of the host organism, which, together with the factors of the stomach environment, create a high rate of genomic variability of *H. pylori* [2,5], which contributes to the active evolution of the pathogen and its adaptation to its host. Increased HR variability (genes *cagA* and *vacA*) leads to the development of the most serious diseases of the stomach and PPD: atrophic gastritis, peptic ulcer disease, and stomach cancer.

Since ancient times, people have known that watercress has a lot of medicinal properties. This plant is very often used in folk medicine. The roots of the plant contain a lot of essential oil, tannins, alkaloid and glycoside acorin, calamine. Its leaves also contain many tannins and essential oils. This oil consists of a mixture of terpenes and sesquiterpenes, azarylaldehydes, which provides a specific smell. And in the rhizome of the flatbread there is a small amount of fragrant soap, vitamins, protein, starch and minerals. A decoction of this plant can be taken to treat stomach aches. The roots have an effect that increases appetite, perfectly improves digestion, and strengthens the reflex separation of all gastric juice. Today, marsh wort is used in folk medicine as a good remedy for the treatment of peptic ulcers[4,6].

The purpose of the study is the effect of phytoremedies (leaves and juice of aloe and birch buds) on the condition of the mucous membrane of the stomach and duodenum in patients with peptic ulcer with hypertension and type 2 diabetes

Research materials. All patients received inpatient treatment in the gastroenterology department of Chernivtsi Regional Clinical Hospital in 2013-2016. Diagnostics was carried out in accordance with the National recommendations of the Unified clinical protocol of primary, emergency and secondary (specialized) medical care for patients with PVS and DPK in adults, approved by the order of the Ministry of Health of Ukraine No. 613 of the Ministry of Health of Ukraine dated September 3, 2014. Determination of the stage and degree of arterial hypertension (AH) was carried out according to the criteria recommended in 2013 by the European Society of Hypertension (ESH) / European Society of Cardiology (ESC). The diagnosis of type 2 diabetes was established according to WHO standards 2006/2011 ($HbA_{1c} > 6.5\%$, fasting plasma glucose ≥ 7.0 mmol/l, postprandial glycemia after 2 hours ≥ 11.0 mmol/l).

Diagnosis was carried out in accordance with the National recommendations of the Unified clinical protocol of primary, emergency and secondary (specialized) medical care for patients with PVS and DPK in adults, approved by the order.

Research results. Aloe leaves and juice contain vitamins, enzymes, phytoncides, resinous substances, traces of essential oils, as well as anthraglycosides (aloin, nataloin, rhubarberon, homonataloin, emodin). Calcium (79.1 mg/g) is the most abundant among macronutrients in leaves, and barium (14.90 μ g/g), selenium (11.90 μ g/g), and strontium (17.64 μ g/g) are among micronutrients. but especially a lot of lithium (162.00 μ g / g) and boron (94.00 μ g / g). Medicinal

properties of aloe vera: choleric, increases the secretion of digestive glands, improves appetite and digestion, anti-inflammatory, anti-burn, antibacterial against staphylococci, streptococci, diphtheria, typhoid and dysentery bacilli. Aloe vera juice and extract are widely used for the treatment of gastrointestinal diseases, such as: gastritis and ulcers of the stomach and duodenum, constipation[6,7].

Nowadays, birch is an integral element of the landscaping of our cities and villages and is widely used in the practice of a doctor. Birch buds contain 3-5.5% of essential oils, resinous substances, flavonoids, saponins, sesquiterpene lactones, phytoncides, vitamins. Birch leaves are rich in essential oils (0.05-0.8%), saponins (3.2%), ascorbic acid (2.8%), resinous substances, carotene, flavonoids, nicotinic acid, tannins, glycosides. The most healing in birch is birch sap, which contains a unique set of useful components - sugar (1-4%), minerals (sodium, magnesium, aluminum, iron, strontium, silicon, titanium, barium, manganese, nickel, calcium, copper, zirconium, potassium, phosphorus). The most effective infusions and decoctions of birch buds are diuretic, choleric and antiseptic. Application in the treatment of atherosclerosis, edema of cardiac etiology, anemia, giardiasis, tracheitis and other diseases. Recipe for tincture for stomach ulcers[1,8,9].

Take 50 g of birch buds and pour them with 0.5 l of alcohol, infuse the buds, shaking occasionally, for 3 weeks in a dark place. Then strain the infusion and take 20 drops three times a day 20 minutes before meals. Birch raw materials are used in the production of activated carbon "Carbolene", which effectively absorbs bacterial toxins and poisons, which is used in dysentery, flatulence, spasms, dyspepsia, increased acidity, allergies, atherosclerosis. [1,2,3,10,11,12].

It is known that every year the comorbidity of pathologies occurs more often and, according to the results of a study by D. Campbell-Scherer (2010), is up to 69% in young people, up to 93% in middle-aged patients, and up to 98% in elderly patients. However, the number of multimorbid conditions is also increasing and reaches up to 10% or more among patients of the youth period and up to 80% - among patients of elderly and senile age. Taking into account the identified metabolic disorders (changes in lipid metabolism, glucose, etc.), which are risk factors for the development of endothelial dysfunction [5,13,16,17] and an early prognostic sign in middle-aged people lead to an increase in arterial pressure, the development of peptic ulcer of the stomach and duodenum, diabetes. The combination of pathologies in patients with hypertension increases the mortality by 2.5–3 times and with type 2 diabetes mellitus by 4 times compared to the total number of the population. However, the combination of PVS and DPC with hypertension and type 2 diabetes, which are pathogenetically related and mutually burdened, complicate the diagnosis and treatment of diseases [14,18,20].

*In the structure of PVS and DPK, HR-associated forms remain dominant and make up from 70 to 88% of this pathology [3,17,18], the high virulence of which is determined by genes *cagA*, *vacA*, *uceA*, *babA*. Interesting in this aspect is the presence of toxigenic strains*

CagA, VacA, which are associated with the development of atrophic gastritis, peptic ulcer, stomach cancer, etc. [5,15,16,17,20]. Their influence leads to disruption of gastrointestinal hormones, leptin and ghrelin, glycosylated hemoglobin, which plays a major role in the development of metabolic disorders [11, 14, 19, 20].

Conclusion. Since aloe and birch buds have a wide range of medicinal properties, namely, choleric, anti-inflammatory, antiseptic, anti-burn, and at the same time enhance the secretion of digestive glands, improve appetite and digestion, antibacterial property against staphylococci, streptococci, diphtheria, typhoid and of dysentery bacilli, allows establishing their influence on the course of peptic ulcer of the stomach and duodenum in combination with arterial hypertension and type 2 diabetes.

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EXPLORING THE EFFICACY OF AI CHATGPT IN ENHANCING SPEAKING SKILL AT LYCEUMS**Kasimova M.***EFL teacher at "Temurbeklar maktabi"
military-academic lyceum*DOI: [10.5281/zenodo.14503400](https://doi.org/10.5281/zenodo.14503400)**Abstract**

With advancements in Artificial Intelligence (AI) and its increasing integration into educational technologies, there is a need to evaluate the specific impacts on language proficiency. This study examines the effectiveness of AI chatbots, particularly ChatGPT4, in improving speaking skills among students in an academic lyceum setting. It aims to provide empirical evidence on the potential of AI chatbots to enhance language education by making it more interactive, engaging, and efficient. Using qualitative methods, including detailed surveys and direct observation, the study explores how AI chatbots can serve as personalized learning assistants, offering tailored feedback and interactive communication exercises. Key findings indicate significant improvements in vocabulary acquisition and speaking confidence, though challenges such as connectivity issues and feedback effectiveness were noted.

Keywords: Artificial intelligence (AI), AI chatbots, AI Chat GPT, speaking proficiency, technology in language acquisition.

Introduction

In recent years, the integration of AI technology into language learning environments has shown promising results in enhancing students' language skills, particularly in speaking through authentic contextual learning. Authentic contexts, crucial for language acquisition, provide learners with real-life scenarios that engage and challenge them, enhancing their language skills in practical situations [1]. Traditional AI-powered chatbots have become key in promoting such learning, offering conversational practice in supportive and immersive settings [2]. However, the effectiveness of these AI tools among specific groups, such as Uzbek learners of English, has not been thoroughly investigated.

This study aims to evaluate the effectiveness of AI chatbots, especially ChatGPT4, in enhancing the speaking skills of academic lyceum students. Unlike traditional methods that may not offer consistent interactive opportunities, AI chatbots provide extensive practice in speaking, immediate feedback, and personalized language learning experiences [3]. These features are particularly beneficial for academic lyceum students who require intensive preparation for standard examinations (IELTS, National CEFR) and value direct and immediate feedback to improve their language proficiency.

By exploring these areas, the study seeks to deepen our understanding of AI's potential in language learning and to identify effective strategies to enhance speaking skills among learners. The study focuses on the nuances of AI ChatGPT technologies for improving speaking, aiming to illustrate how such tools can be integrated effectively to support and enhance language learning outcomes. The research question is:

How effective are AI chatbots, specifically ChatGPT4, in enhancing the speaking skills of lyceum students?

Recent studies have shown that AI chatbots are playing an increasingly significant role in language ed-

ucation, with their use expanding across various educational settings. Employing chatbots to strengthen speaking skills can lead to noticeable improvements in fluency and vocabulary growth [3]. There are two types of chatbots based on how they work: text-based and voice-enabled. Voice-enabled chatbots have been suggested as a useful tool for learning and practicing second language (L2) speaking skills [3]. Additionally, L2 learners often prefer chatbots over human partners because they are afraid of making mistakes or seeming less capable when talking to humans [4].

With advancements in Artificial Intelligence (AI), Machine Learning (ML), Natural Language Processing (NLP), and Deep Learning, developers are now creating more sophisticated humanoid chatbots. While these chatbots don't claim to have comprehensive knowledge, they aim to mimic realistic human interactions [5]. According to Wu & Yu (2024), AI chatbots have a more significant impact on higher education students than on primary and secondary learners. Short interventions lead to better learning outcomes than longer ones, likely due to the novelty effect of AI chatbots, which tends to diminish over time [6]. To improve effectiveness, future designs should include human-like avatars, gamification, and emotional intelligence features.

A study by Han demonstrated that *Alexa*, a widely-used voice-enabled chatbot, can enhance students' speaking abilities by engaging them in conversational practice. This research found that chatbot-facilitated learning notably improved students' pronunciation and fluency in the language [7]. Additionally, feedback from post-experiment questionnaires revealed that integrating such technology increased students' enthusiasm and motivation for learning. The sentence needs a slight correction for grammatical accuracy. Similarly, along with *Alexa*, *Google Assistant* has also been shown to positively affect students' language skills. Research indicated that students experienced reduced embarrass-

ment and anxiety while practicing with chatbots. Moreover, chatbots have been found to support self-directed learning of foreign languages in environments where native speakers may be unavailable [4]; [7].

While general chatbots can be appealing, research has indicated that they might not be as effective for second language (L2) learners due to their inability to meet specific learning needs [4]. Consequently, when designing a chatbot for language learning, several factors need to be considered, including the potential for language learning, the suitability for learners, and the authenticity of the content [4]. The potential for language learning should encompass elements such as interactional modification and a focus on relevant tasks. The suitability for learners should evaluate aspects like language proficiency, age, learning styles, and individual traits. Finally, the authenticity criterion requires that the chatbot content's reflection of real-world tasks that learners are likely to face, enhancing the overall learning experience.

This study assessed the effectiveness of ChatGPT4 in enhancing speaking skills among academic lyceum students over a one-week period using

qualitative data. Thirty students, aged 16-17 with pre-intermediate English proficiency, participated using ChatGPT version 4. Participants' use of ChatGPT was monitored through screen recordings and twice-weekly interviews, capturing their interactions and reflections. Qualitative data, including screen photos, interviews and the survey (Appendix 1) with open-ended and multiple-choice questions, were analyzed to assess the chatbot's impact.

The post-survey questionnaires offered insights into students' experiences and perceptions. Most students (63.3%) utilized ChatGPT for vocabulary building and conversational practice (53.3%), followed by pronunciation guidance (43.3%) and grammar practice (23.3%) (Chart 1). Regarding their interest in learning speaking skills with ChatGPT compared to traditional methods the majority of students, 63%, find learning with ChatGPT more interesting. Conversely, 26.7% of the students find it less interesting. Additionally, 10% of the students feel that learning with ChatGPT is the same as traditional methods.

In what ways have you used ChatGPT for improving your speaking skills?

30 responses

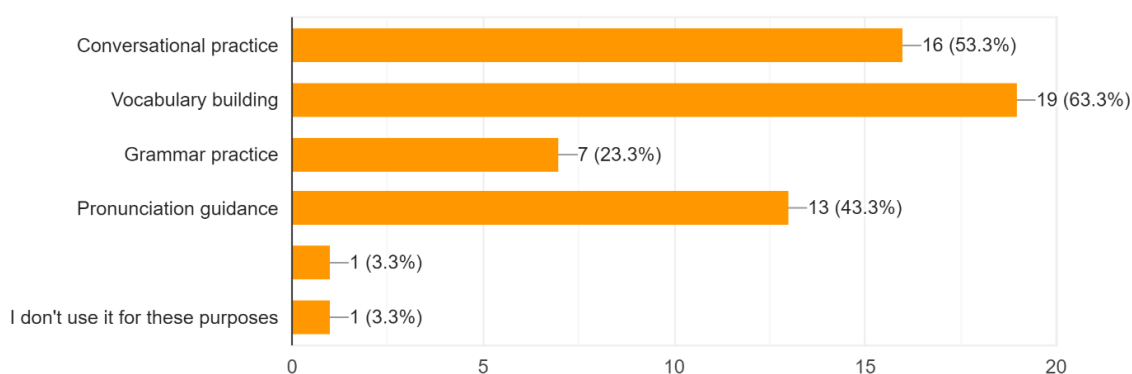


Chart 1

How do you feel about learning speaking skills with ChatGPT compared to traditional ways?

30 responses

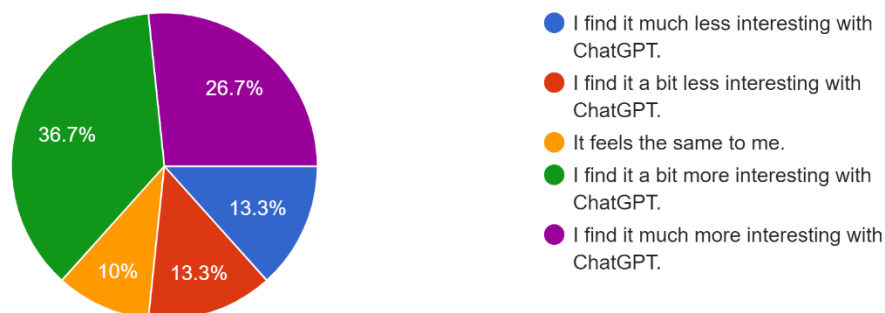


Chart 2

Despite the advantages, some challenges were identified. Internet connection problems often interrupted the flow of conversations, hindering consistent practice. Additionally, some students struggled with mispronunciations and frequent errors. Moreover, while ChatGPT provided immediate feedback, it was not always effective in correcting these issues, leading to frustration and repeated mistakes.

Daniel said, “*Sometimes ChatGPT doesn’t understand me though.*”

Long pauses during interactions with ChatGPT also disrupted the natural rhythm of conversation, making practice sessions less engaging and effective. Not all students benefited equally from using ChatGPT. Some students who initially showed great interest did not see significant improvement in their performance. This suggests that while ChatGPT can be a powerful tool, it may not be sufficient on its own to address the needs of all learners, especially those requiring more fundamental support and motivation.

This study contributes to the growing body of literature on AI in education by demonstrating the effective use of ChatGPT in improving language skills. It also highlights critical areas for future development, ensuring that AI tools like ChatGPT can more effectively meet the diverse needs of language learners around the world.

Conclusion. In conclusion, using ChatGPT in our speaking classes significantly enhanced students’ speaking skills by offering rapid vocabulary acquisition, boosting confidence, providing personalized practice opportunities, delivering immediate feedback, and exposing students to native-like speech. However, challenges such as connectivity issues, difficulties with mispronunciations and errors, long pauses, and varying levels of effectiveness among students highlight the need for a balanced approach that combines technology with traditional teaching methods to support all learners effectively.

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INNOVATIVE APPROACHES TO GRAMMAR INSTRUCTION IN ENGLISH LANGUAGE TEACHING

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Abstract

The field of English Language Teaching (ELT) has witnessed significant advancements in grammar instruction, driven by innovative pedagogical approaches that enhance learner engagement and understanding. This article explores three prominent methods: Task-Based Learning (TBL), Technology-Enhanced Instruction, and Inquiry-Based Learning.

Task-Based Learning emphasizes the use of meaningful tasks as a vehicle for language acquisition, encouraging students to focus on language form through contextualized scenarios. This approach fosters authentic interaction and communication, allowing learners to use grammar in practical situations instead of isolated drills. By completing tasks that mirror real-life language use, students not only grasp grammatical structures more effectively but also develop essential skills such as critical thinking and collaboration.

Technology-Enhanced Instruction leverages digital tools and resources to create interactive and immersive learning experiences. Online platforms, language learning apps, and multimedia resources offer dynamic ways to present grammar concepts. By incorporating gamification and adaptive learning technologies, educators can cater to diverse learning styles and levels. These tools facilitate instant feedback and self-paced learning, empowering students to take control of their grammar acquisition journey while making the process more engaging.

Inquiry-Based Learning prioritizes students' natural curiosity, encouraging them to explore and question language rules and patterns. This approach shifts the focus from rote memorization to critical analysis, as students investigate grammar through discussions, research, and collaborative projects. By fostering an inquiry mindset, learners become active participants in their education, developing deeper comprehension of grammatical concepts and an appreciation for the complexities of language.

Keywords: grammar, learning, communication, tasks, interactive, online platforms, sentence structure, critical thinking, approaches.

Introduction

In English Language Teaching (ELT), traditional grammar instruction often relies on rote memorization and prescriptive practices, leading to limited student engagement and comprehension. Innovative approaches to grammar instruction focus on integrating communicative methods, technology, and contextualized learning to improve students' understanding and usage of grammar. By shifting the focus from decontextualized rules to meaningful interactions, educators can foster a more dynamic and engaging learning environment. This paper explores three innovative approaches—task-based learning, technology-enhanced instruction, and inquiry-based learning—that not only enhance grammar acquisition but also empower students to use grammatical structures more confidently and effectively in real-life communication.

Task-Based Learning

Task-based learning (TBL) emphasizes the use of authentic tasks to teach grammar in a meaningful context. Instead of presenting isolated grammatical rules, this approach involves students engaging in real-life tasks that require them to use grammar dynamically. For instance, rather than simply learning the past tense through drills, students might plan a trip and share their experiences in small groups. This method promotes active learning and encourages students to apply grammatical structures in context, thereby enhancing their

retention and understanding. Additionally, TBL fosters collaboration and communication among students, making grammar instruction not just a mechanical process but a more interactive and engaging experience.

Task-based learning (TBL) has emerged as an effective approach to teaching grammar, emphasizing the importance of meaningful communication and real-world application. Unlike traditional methods that often prioritize rote memorization of rules and forms, [1,273] TBL centers around the use of authentic tasks that require students to use grammatical structures in context. This shift from a form-focused to a meaning-focused approach is instrumental in enhancing students' understanding and retention of grammar.

In TBL, learners engage in tasks that mimic real-life situations, such as planning a vacation, conducting an interview, or solving a problem collaboratively. For instance, students might be asked to create a presentation about their favorite hobby, requiring them to utilize the present simple and continuous tenses. This context not only makes the grammar more relevant but also encourages students to experiment with language in a safe environment. By using grammar structures to complete a task, learners can immediately see the practical application of grammar rules, which facilitates deeper understanding and retention.

Additionally, TBL promotes collaboration and communication among students. Working in pairs or

small groups enhances peer interaction, allowing learners to negotiate meaning and provide each other with feedback. This social aspect of learning reinforces grammatical concepts through discussion and shared problem-solving. Moreover, the focus on completing tasks encourages learners to prioritize fluency over accuracy initially, reducing anxiety and increasing confidence when using English. [2, 57]

In summary, task-based learning effectively teaches grammar by embedding it within meaningful contexts. By engaging students in practical tasks, TBL fosters an active learning environment where grammar is not just an isolated set of rules to memorize, but a vital component of effective communication. This approach not only enhances grammatical proficiency but also equips learners with the confidence and skills necessary for real-life language use.

Technology-Enhanced Instruction

The integration of technology into grammar instruction offers innovative ways to engage learners and provide immediate feedback. Tools such as language learning apps, interactive online exercises, and grammar-checking software can make grammar practice more interactive and enjoyable. For example, platforms like Quizzes or Kahoot! Can be used to create fun, competitive exercises that reinforce grammar concepts. [4,81] Additionally, technology enables personalized learning, allowing students to progress at their own pace. Online forums and discussion boards can also encourage peer interaction, where students can practice their grammar skills in written communication. By leveraging technology, educators can create a more vibrant and responsive grammar classroom that caters to the diverse needs of students.

Integrating technology into grammar instruction can make learning more engaging, interactive, and effective. Here are several examples using technology to teach grammar concepts:[5, 61]

1. *Interactive Grammar Websites*: Platforms like Grammarly, ProWritingAid, and NoRedInk offer interactive exercises that help students practice grammar rules, receive instant feedback, and learn from their mistakes. These tools allow students to edit and improve their writing while understanding grammar in context.

2. *Gamification*: Websites like Kahoot!, Quizizz, and Quizlet allow educators to create grammar-focused quizzes and games that students can play individually or in teams. These platforms use competitive elements to make grammar practice fun. For example, a Kahoot! Quiz on verb tenses can encourage students to engage with the material actively.

3. *Educational Apps*: Apps like Duolingo and Babbel offer grammar practice as part of their language learning modules. These apps often present grammar rules in a fun, gamified manner, allowing learners to practice at their own pace through interactive activities.

4. *Video Tutorials*: Platforms like YouTube host countless channels dedicated to teaching grammar. Teachers can assign relevant videos to supplement classroom instruction. For instance, an informative video on the difference between “who” and “whom” can provide a clear explanation that students can revisit as needed.

5. *Blogs and Writing Platforms*: Tools like Edublogs or Google Docs enable students to write and receive peer feedback online. Teachers can create prompts focused on specific grammar points, allowing students to practice writing while also focusing on grammatical accuracy.

6. *Grammar Check Tools*: Incorporating tools like Microsoft Word’s Editor or Google Docs’ built-in grammar checker can help students self-assess their writing. As students draft their work, they can learn from the corrections suggested by these tools.

7. *Virtual Classrooms*: Online platforms like Zoom or Microsoft Teams allow for breakout rooms where students can engage in grammar drills or peer-teaching sessions. This setup fosters collaborative learning, where students can practice grammar in discussion and conversation.

8. *Social Media*: Teachers can leverage platforms like Twitter or Instagram for creative grammar challenges, such as writing sentences with a specific grammatical structure using a designated hashtag or sharing “grammar tips of the day” with their peers.

By utilizing these technological tools and platforms, educators can create a dynamic and engaging grammar learning environment that encourages students to explore, practice, and apply grammatical concepts in varied contexts.

Inquiry-Based Learning

Inquiry-based learning (IBL) encourages students to explore grammatical concepts through questioning and investigation. This approach positions students as active participants in their learning process, prompting them to discover grammatical rules and patterns on their own. For instance, teachers can present students with sentences that contain grammar errors or variations and ask them to analyze and correct these examples collaboratively. This encourages critical thinking and drives engagement, as students become invested in finding solutions. By fostering a sense of curiosity and ownership over their learning, inquiry-based approaches not only improve grammatical understanding but also enhance learners’ overall language competence, equipping them with the skills needed for effective communication. [3, 49]

Inquiry-based learning (IBL) can effectively engage students in exploring grammatical concepts through questioning and investigation. Here are some examples of implementing IBL to teach grammar:

1. Questioning the Rules of Grammar

- Activity: Begin with a complex sentence that contains multiple grammatical constructs. Present students with a question: “What makes this sentence grammatically correct?”

- Investigation:

- Students work in pairs or small groups to analyze the sentence, identify clauses, parts of speech, and punctuation.

- They formulate their hypotheses about what rules apply and collaboratively investigate grammar rules using grammar reference books or online resources.

- Each group presents their findings, discussing variations or exceptions to the rules they discovered.

2. Exploring Sentence Structure

- Activity: Pose the question, "How can changing the structure of a sentence affect its meaning?"

- Investigation:

- Provide students with a short text or some sentences on a topic (e.g., "The dog chased the cat" vs. "The cat was chased by the dog").

- Students can investigate different sentence structures, rewriting the sentences using passive voice, varying lengths, or creating compound sentences.

- Each group shares their rewritten sentences and discusses how the structure impacts clarity and emphasis.

3. Verb Tense Investigation

- Activity: Start with the question, "How do different verb tenses change the meaning of a sentence?"

- Investigation:

- Provide scenarios or prompts, asking students to write a short paragraph about a past event using different verb tenses.

- Students then create a timeline, mapping out past, present, and future occurrences of their described event using the appropriate tenses.

- Groups can share their timelines and discuss how the choice of tense affects the perception of time and action.

4. Grammar in Context

- Activity: Pose the question, "How does grammar function differently in spoken vs. written language?"

- Investigation:

- Have students collect examples from spoken language (like transcripts of conversations, podcasts, or interviews) and written language (like articles, essays, or creative writing).

- Students analyze the grammatical structures used in each context and investigate stylistic choices, such as informal contractions in speech versus formal grammar in writing.

- In groups, they can present their findings, offering insights into how formality affects grammar and sentence construction.

5. Punctuation Exploration

- Activity: Ask students, "How does punctuation alter the meaning of a sentence?"

- Investigation:

- Provide sentences that have ambiguous meanings based on punctuation (e.g., "Let's eat, Grandma!" vs. "Let's eat Grandma!").

- Groups explore different punctuation marks and their respective rules, rewriting sentences to alter meaning through punctuation changes.

- Each group shares examples of sentences where punctuation made a significant impact on meaning, leading to discussions about clarity and miscommunication.

6. Peer Review and Collaboration

- Activity: Invite students to ask, "How can peer feedback improve grammatical accuracy?"

- Investigation:

- Have students exchange drafts of their writing pieces, focusing on grammar.

- Using guiding questions, such as "Did the writer use subject-verb agreement correctly?" or "Are the pronouns clear and correctly placed?" groups review each other's work.

- They revise their writing based on peer feedback and reflect on how the review process helped them understand and apply grammar rules more effectively.

7. Grammar Field Trip

- Activity: Pose the question, "How do we see grammar in the world around us?"

- Investigation:

- Organize a field trip where students document examples of grammar they observe in real-world contexts (e.g., signs, advertisements, menus).

- Once back in class, students can create presentations or collages analyzing the grammatical choices they encountered, discussing why certain forms were used in specific contexts and the impact on audience reception.

By using IBL approaches, students are empowered to take charge of their learning. They engage deeply with grammar concepts, develop critical thinking skills, and enhance their ability to communicate effectively.

In conclusion, integrating TBL, technology, and inquiry-based methodologies represents a paradigm shift in grammar instruction within ELT. These innovative approaches not only enhance learners' grammatical proficiency but also cultivate essential skills that are crucial in navigating the complexities of language use in real-world contexts.

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THE MAIN PEDAGOGICAL CONDITIONS OF PROFESSIONAL AND PERSONAL FORMATION OF STUDENTS

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Abstract

The article discusses the main pedagogical conditions that contribute to the professional and personal development of students. The main conditions discussed are the use of personality-oriented teaching technologies, the formation of professional values and ethical standards, the development of practical skills, the creation of a favorable professional environment and the development of mentoring and coaching methods. The systematic creation and implementation of pedagogical conditions for improving the personal qualities, values and abilities of students increases their responsible attitude to future professions. The emphasis is on the fact that the process of professional development is organized, managed and controlled. The pedagogical conditions that influence the professional development of students in the learning process are defined and described.

Keywords: professional personality, student, pedagogical conditions, professional formation, skills, higher education institution, professional values, professional environment, mentoring.

One of the main tasks facing the education system in the era of globalization is the formation of competitive, competent, professionally trained specialists. The formation of professional and personal qualities of students is one of the most important tasks not only of educational institutions, but also of society as a whole. The development of professional and personal qualities of students at the university ensures their success in the future labor market. In this direction, the importance of pedagogical conditions that contribute to the improvement of personal qualities, the development of values and abilities of students increases. To implement any pedagogical phenomenon in any educational process, it is necessary to create a certain set of conditions. Before defining the main pedagogical conditions for the professional and personal development of students, first of all, let us analyze the concept of "pedagogical conditions". In pedagogy, "conditions" are defined as factors on which the effectiveness of the functioning of the pedagogical system depends [1].

In pedagogical research, the concept of a contract is considered as factors, situations, and measures that determine the effective functioning and development of the pedagogical system. The methodological analysis of pedagogical conditions is reflected in the work of Y. K. Babansky, V. I. Andreev, N.Y. Postalyuk and others. Under the pedagogical condition, Y. K. Babansky understands a situation when the components of the educational process interact with each other and create an opportunity for teachers to work productively, manage the educational process, and for students to work successfully [2].

Domestic and foreign scientists have studied various aspects of this process and prepared a number of recommendations aimed at improving the professional and personal development of students. In this regard, it is possible to identify several pedagogical conditions

for the professional and personal development of students:

The use of technologies of personality-oriented learning. Personality-oriented learning is an effective method aimed at taking into account the individual abilities, interests and developmental characteristics of each student. For example, each student may have their own learning style: one understands visual material better, while others absorb information faster with the help of practical tasks. The use of such teaching methods helps to increase students' interest in classes and develop their creative potential. The works of the Russian scientist, Doctor of Psychology K. B. Zharylbaev widely examine the relationship in the field of personality development and education. He emphasized that the main goal of the education system is not only for students to gain knowledge, but also to improve their professional and personal qualities [3].

Foreign scientists are also studying the importance of personality-oriented learning. For example, the American researcher J. Dewey proved the need to create favorable conditions for the self-development of the individual, that his active participation in the educational process increases the effectiveness of the educational process. In his opinion, education should be aimed at developing the individual interests and creative potential of each student [4].

Formation of professional values and ethical standards. Professional values and ethical standards determine the responsibility, honesty and diligence of students as future specialists. Kazakh scientist Abdigapparova A. E. shows the importance of teaching ethical standards in the formation of professional and personal qualities of students. In his works, the main pedagogical task is considered to be the assimilation of professional moral values by students in the educational process [5]. E. Shane studied the influence of

professional ethics on personal values. In his opinion, ethical values and standards develop students' ability to make decisions based on moral responsibility and integrity in a professional environment [6].

To form professional values and ethical standards, special courses and trainings can be held in an educational institution. This teaches students to be prepared for various moral dilemmas. For example, future educational psychologists are taught such important values as maintaining confidentiality when working with a client.

Development of practical skills. An important place in the professional development of students at universities is occupied by the development of practical skills. In order to develop students' ability to apply the acquired knowledge in practice, special attention must be paid to professional practice in an educational institution. In her research, the teacher, specialist in the field of education and scientist Kudaibergenova M. Zh. emphasizes the importance of practical skills in preparing students for their future profession. She emphasizes the need to ensure consistency between theory and practice in the educational process. In addition, she puts forward the need to improve students' professional skills by applying their knowledge in practice [7].

Theory and practice are closely linked in the dual education system of Germany. In addition to studying within this system, students work at production sites every semester to gain professional experience. As a result, they, along with a diploma, gain the necessary experience, which gives a great advantage when finding a job.

American psychologist, scientist D. Kolb in his research examines the effectiveness of learning based on experience, and argues that students should not only theoretically apply knowledge, but also hone their experience, applying it in practice. According to D. Kolb, "learning is practice" and students' gaining professional experience at universities has a positive effect on their professional and personal development [8].

Creating a favorable and developing professional environment. Creating a favorable environment for the professional development of students contributes to their improvement as future specialists. In this environment, students have the opportunity to share their new ideas and conduct an open dialogue with colleagues and teachers. A supportive environment increases students' confidence and promotes the development of personal initiatives. In world psychology, in the theory of socio-cultural development of the Soviet psychologist L. S. Vygotsky, a supportive environment is considered the most important factor in the development of personal qualities of a person. In his opinion, human abilities develop due to the social environment, therefore the educational environment should support and allow students to develop [9]. The motivation theory of the representative of humanistic psychology A. Maslow reveals the importance of creating a supportive environment for students. Maslow notes that through a supportive environment, a person's desire for self-development increases, which, in turn, contributes to the professional and personal development of students [10].

Development of mentoring and coaching. Mentoring and coaching play a major role in improving students' professional competence. In mentoring programs, experienced professionals provide students with guidance, professional advice, and help them define their professional goals. For example, in many US higher education institutions, mentoring programs help students adapt and define professional goals.

One of the scientists who conducted research on mentoring in Kazakhstani pedagogy is Satpayeva R.K. She argues that mentoring is a necessary method in a higher education institution for teaching students to master professional skills and apply them in practical practice [11]. Among foreign scientists, T. Scatcher and B. Parsons studied whether the widespread use of mentoring and coaching in a professional environment allows students to fully realize their potential and develop professionally. In their research, mentoring is an effective pedagogical tool that helps students manage themselves and achieve their personal goals [12]. Thus, the professional and personal development of students at a university is a complex process that shapes their professional qualifications and personal qualities as future specialists. Research by domestic and foreign scientists shows the importance of pedagogical conditions in ensuring the professional and personal development of students. Through personally oriented training, the formation of professional values and ethical standards, the development of practical skills, the creation of a favorable environment and the development of mentoring, it is possible to create favorable conditions for the professional and personal development of students. By effectively using these pedagogical conditions, educational institutions can ensure that students become competitive and competent specialists in their field. Pedagogical conditions aimed at the professional and personal development of students allow them to play an important role in society in the future.

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POLITICAL SCIENCES

FORCED MIGRATION FROM UKRAINE

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Abstract

The article analyzes the problem of the forced migration of the population of Ukraine, the active phase of which in the recent history of the country covers the period 2014-2024. A feature of this phenomenon in the life of Ukrainian society was the wave outflow of the population from the Eastern and Central regions of the country under the pressure of threats to life and security during the counter-terrorist operation (2014) and as a result of the fighting during the Russian-Ukrainian war which began in February 2022. The relevance of the issue is also added by the existing contradiction between the parties to the "emigrant process" to the EU from Ukraine in their views on the further fate of certain groups of migrants (men of draft age) whose rights are protected by the European law, and the lack of a strategy in the Ukrainian government for the return of migrants to the country.

Keywords: forced: migration, Russian-Ukrainian war, internally displaced persons, refugees, "evaders".

Problem statement. In the modern sense the term "migration" is the right of any person to change their temporary or permanent place of residence. Free choice is correlated with mobility and the search for new life guidelines for a free individual as required by democracy. The forced migration is a special type of migration. It involves the relocation of people (both within the state and beyond its borders) under the pressure of circumstances of an internal or external nature and for various reasons. Their objectification creates uncontrollable circumstances that pose challenges and threats to human security and life, and require immediate decisions to change the environment and locality or country of residence. Modern political and legal practice recognizes three phenomena of migrants.

Refugees are persons living outside their country and are unable and/or unwilling to return due to risks of persecution and/or for their lives.

Asylum seekers are people who have filed an official request for political asylum in a particular country. If this request was granted, then in fact they are the same refugees.

Internally displaced persons (IDPs) or displaced persons are individuals or groups of individuals who in order to avoid the consequences of armed conflict, situations of widespread violence, human rights violations or natural or man-made disasters, have been forced or obliged to flee or leave their homes, or places of habitual residence.

A feature of forced migration is that, in addition to the above-mentioned characteristics, this process is greatly influenced by managerial miscalculations and

the indifference of the authorities of many countries to security conditions in general and socio-economic aspects of people's lives in particular [1, p. 64-66].

The purpose of the article is to reveal the policy of the Ukrainian state and the European Union countries regarding forced migration of the population in times of crises in the modern history of Ukraine and during the Russian-Ukrainian war.

Analysis of recent researches and publications. Disclosure of the national specifics of the stated topic [Forced migration from Ukraine] is based on the regulatory framework of state authorities of Ukraine, UN reports and analytical structures of domestic and foreign locations, articles by domestic and foreign authors.

A thorough analysis of the current issues is provided by Ukrainian authors. The works of such authors as O. Rovenchak, L. Amdzhadin, O. Malinovska, I. Mironyuk, O. Poznyak, A. Atamanov, A. Haidutsky, T. Bondar, O. Ganyukov, A. Derevko, A. Suprunovsky, N. Lomonosova, Yu. Kabanets, V. Cherednichenko, K. Zatulko, E. Libanova, A. Golovko, etc. deserve attention.

Among western researchers, the works of D. Zukhovskiy, S. Castles, I. Stalker, R. Hunter and others should be noted.

One of the author's successful attempts to look at this problem comprehensively is the scientific work (thesis of Doctor of Sciences) O. Ryndzak "Migration Policy in the System of Integration Processes of Ukraine" [2].

Presentation of the main material. In Ukraine the phenomenon of forced migration has its own pre-history, development due to the conflict of interests of the political and economic elite, regional and internal dynamics regarding socio-economic problems, the direction and regionalization of refugees abroad during the war of Russia against Ukraine, the peculiarities of the reaction of the countries of location of Ukrainian refugees concerning the prospects of their stay, etc. The multifacetedness and complexity of the specified topic dictated the need to reflect the specified problems by revealing a number of issues inherent in modern Ukrainian society (starting from the 21st century) regarding forced migration. Starting from 2014, this issue has revealed both the commonality of actions of the European community within the framework of EU policy, and the own vision of this issue by the national governments of European countries which runs counter to its vision by the government of Ukraine.

Thus, the article draws attention to such issues as: 1) the prehistory of forced migration; 2) countries of residence and problems of emigrants from Ukraine; and 3) Ukrainian strategy for the return of migrants.

1. Background of forced migration.

In the modern history of Ukraine (starting from the 20th century) within its national borders the phenomenon of resettlement of a large number of people (national-ethnic groups) is primarily associated with the resettlement of Crimean Tatars during the time of I. Stalin in the 1940s and 1950s. This act was based on suspicion of collaborationism of a certain part of the Crimean Tatars with the German occupation administration. Another case is related to the Declaration "On the recognition of repressive acts against peoples subjected to forced resettlement as illegal and criminal and on ensuring their rights" adopted by the Supreme Soviet of the USSR on December 14, 1989 which concerned the restoration of civil rights of Bulgarians, Armenians, Greeks and Germans, who also suffered from suspicion of lack of loyalty to the Soviet government during the war. Therefore, the act of remigration was a kind of step by the authorities towards these national groups regarding their expectations and attitudes.

In the recent history of Ukraine the problem of forced migration returned in 2014, when an anti-terrorist operation was launched in the territory of Luhansk and Donetsk regions. Article 9 of the Law of Ukraine "On Temporary Measures for the Period of the Anti-Terrorist Operation" introduced the concept of "migration" (immigration and emigration)", and established the procedure for the authorities' actions regarding categories of migrants [3]. Already in June 2014 more than 18 thousand migrants – IDPs from the areas of the anti-terrorist operation were registered in Ukraine at the level of state statistics [4].

On April 15, 2014 the Acting President of Ukraine, Chairman of the Verkhovna Rada of Ukraine O. Turchynov signed the Law of Ukraine No. 1207-VII "On Ensuring the Rights and Freedoms of Citizens and the Legal Regime on the Temporarily Occupied Territory of Ukraine" [5]. During this period, many European countries also introduced an urgent abolition of the visa regime for Ukrainians seeking to travel abroad.

Already in early December 2014, summing up the situation with forced migration in Ukraine, UNHCR (the UN Refugee Agency) provided the following figures:

- 490,046 internally displaced persons (IDPs);
- 229,409 people who voluntarily requested asylum in the Russian Federation;
- 7,363 people who requested asylum in other countries [the leading country was Poland – 2,043 applications] [6, p. 1].

In November of the same year, in the Relief Web (UN) report, these figures were even higher:

- 490,046 IDPs;
- 545,613 refugees [7].

In 2015, according to Relief Web, these figures were even higher: the number of IDPs was 1,117,748 people, and the number of migrants from Ukraine was 763,632 people [8]. As the expert community notes the only country within the EU that "truly" got involved in the work of settling the first wave of emigrants from Ukraine was Germany. In October 2015 the country's government financed the federal project "mobile housing" within the framework of which the focus was on mobile homes for Ukrainian refugees. The project was implemented by direct agreement between the then President of Ukraine P. Poroshenko and the then Chancellor of Germany A. Merkel [9].

However, as the national expert community testifies after 2015 the problem of internally displaced persons remained out of the attention of officials and politicians. In fact, in solving their life problems, they found themselves in a situation of "one on one". Civil society was silent, and the national media were silent as well [10]. The echo of such inaction of the Ukrainian authorities regarding the social adaptation of internally displaced persons, in particular, and the phenomenon of emigration in the life of the country in general, made itself felt with the beginning of the Russian Federation's military actions on the territory of Ukraine on February 24, 2022. Its (echo) deep meaning reflected the familiar "natural egocentrism" of a person in extreme conditions, which called for believing only in oneself and in one's capabilities. In addition, for many migrants it was based on the already acquired experience of life abroad which is an important factor in integration into another cultural and economic space.

Since 2022 the wave of "forced emigration" has gained geometric progression and has captured virtually the entire country. At the beginning of 2023 official data from the Ministry of Reintegration reported 4,867,106 displaced persons but international assessments of the situation already informed about 6-7 million people [11]. This is explained by the fact that not all internally displaced persons were registered through official channels.

The numerical indicators confused two existing factors. The first factor is the permanent situational movement of people, relative to where it gets "hotter". It is about the "movement of the front" and waves of hostilities. As a result, some IDPs in Ukraine continued and continue to move both within the country and abroad [12]. The second factor is human rights violations. In this regard, forced migration researcher N.

Pavliv-Samoil emphasizes that the engine of forced migration, directly or indirectly was the violation of human rights [13, pp. 70-75]. In Ukraine he claims that the practice of restoring violated citizens' rights is virtually absent [13, p. 75]. According to M. Bil, there is also no consistent policy of social protection of IDPs in Ukraine. The author also closely links migration processes with the social vulnerability of large population groups [14].

The consequence of such a situation in the country was the emergence of a socio-psychological dilemma in society – citizen/refugee, in which everyone chooses the option of behavior and survival in their own way. As unfortunate as it is, but since then the state as an institution and a home of common destiny and residence for a large part of the population has begun to lose its existential significance. The risks of the obvious negative of such a confrontation became even more obvious when the country's leadership and politicians of Ukraine raised such fundamental issues of national stability as the lack of labor and mobilization resources in the country. After all, as statistics have shown, the most numerous group of emigrants is people of working age, with competencies and personal aspirations.

2. Countries of residence and problems of emigrants from Ukraine

According to the Ministry of Foreign Affairs of Ukraine, as of June 21, 2023, 8 million 177 thousand Ukrainians were abroad [15]. In more detail, the picture of the migration flow looks as follows. More than half of Ukrainians are in three countries: Poland – 22 %, Germany – 14.6 % and the USA – 11%. Many Ukrainian citizens have found refuge in the Czech Republic – 7.9 %, Italy – 5 %, Canada – 4.9 %, Spain – 3.4 % and Israel – 2.75 %. Almost 63 % of Ukrainians living abroad are adults, 22 % are children under 18. The age of another 15 % of people is not specified.

Only 1 in 16 Ukrainians abroad is registered with the consular authorities. As of June 21, 2023, there were just over 493,000 such citizens, and 88% of them were adults. This number of people indicates that about 20 % of the current population of Ukraine is currently abroad due to the war as of February 24, 2022 [15].

However, it is difficult to answer what the real picture of migration looks like due to the state of “permanent crossing” of the border which is determined by the dynamics of departures and arrivals to the country. For example, as of May 1, 2023, Ukrainian citizens crossed the border with Poland almost 20 million times [15]. In addition, the picture of dynamics began to be supplemented by the phenomenon of “visiting relatives” who were already abroad by their loved ones and friends. Starting from 2024, it was precisely such “tourist visits” that kept the bar of departures and arrivals to the country at high levels. For example, in the first 4 months of 2024, the State Border Service recorded over 7.8 million border crossings.

Unlike the problems of the wave of refugees from the Middle East and Afghanistan which the EU countries experienced in the early 2000s, Europe received refugees from Ukraine in a more calm and organized manner. National governments, city authorities and volunteer organizations have acted in a coordinated and effective manner as circumstances dictated. In addition,

all this work has been coordinated within the EU and has been supported legislatively, organizationally and financially. European solidarity has played a significant role in this matter. The EU leadership first applied a norm adopted 20 years later which had never been used before. It is about providing “temporary protection” to people fleeing armed conflict. Thanks to this, displaced persons from Ukraine instantly received the opportunity to move freely within the EU, the right to work and small social benefits which guaranteed social support. The cross-border force of this norm has been felt from the borders of Poland, Slovakia, and Hungary to the borders of Denmark, the Netherlands, Italy, and Norway.

In addition, the vast majority of Ukrainians has received the status of temporary protection which provides the right to residence, access to medicine, education and the labor market on an equal basis with EU citizens. Some EU countries have also provided additional benefits for Ukrainians (free accommodation in dormitories or separate housing, cash payments, vocational training, etc.) [16].

The consolidation of the efforts of the governments of the EU countries have contributed to the fact that by mid-2024 the primary problems of emigrants from Ukraine were solved, and it itself (the problem) in its “emigration sound” acquired a completely different dimension. It is about the choice of the further life path by the emigrants themselves: either to stay in the country of residence or to return home.

The prospect of staying in the host country for any emigrant means a long path of integration which is not as cloudless as it might seem at first glance. Integration is primarily a change in the usual style and rhythm of life, the basis of which is the restructuring of a person. That is, it is about transforming one's own identity and assimilating the main rules/components of the identity of the host country – culture, history, traditions, beliefs, mythology, narratives, everyday life, etc. The picture of the new reality can be complicated by hostility from the indigenous population, biased attitude of employers, difficulties in finding employment regarding the lack of professional education or lack of competencies, etc. That is, new living conditions can become an unprecedented test for the expectations and self-esteem of an emigrant.

The first bells of the new “realities of life” were felt by emigrants who are in countries with the largest percentage of their presence in the host country. First of all, these countries are trying to reduce their spending on helping Ukrainian refugees [16]. According to estimates by the Kiel Institute for the World Economy, for the period from January 15, 2022 to January 15, 2024, Poland spent approximately 3.3 % of its GDP, the Czech Republic and Bulgaria – 2.1 % each, Slovakia – 1.7 %, Latvia – 1.5 %, and Estonia, Lithuania, Romania and Hungary – approximately 1 % of GDP. For example, in the summer of 2023, the Czech Republic reduced monthly spending on benefits for Ukrainian refugees by a third and adopted a law according to which most refugees are entitled to free accommodation only for the first 150 days after entering the Czech Republic.

The rules for calculating cash benefits for Ukrainians have also changed. For example in Poland, from January 1, 2023 a payment of 50 % of the cost of living in a refugee center was introduced. This applies to those who stay there for more than 120 days. Norway has also followed this path. From now on, Ukrainians who come to Norway (in accordance with the new law) will be forced to live in refugee centers for longer and will have a lower level of payments. They will also be prohibited from returning to Ukraine if they wish to continue their status in Norway. Ireland has set the maximum period of residence in state housing at 90 days for newly arrived Ukrainian refugees. Also, in 2024, the level of social benefits for them was reduced from 220 euros to 38.8 euros per week.

The German path on the arrangement of refugees from Ukraine can be described as a “soft involvement” in a German society. It feels experience in the “Germanization” of the wave of emigration in the early 2000s and the negative reaction of German society to the government’s expenditures from the budget for its maintenance. The new strategy involves the partial cancellation of payments (except for housing and communal) for those who refuse to work without good reason and accelerate the employment process. If earlier Ukrainian refugees had to take language courses to a certain level and then searched for work, priority is now being given to language learning in the working environment. In addition, the qualification and preferences of Ukrainians for work is also considered less priority. From now on, the self-sufficiency of everyone (the emigrant) is a priority in working with refugees through inducing partnerships with state intrict and local business needs

3. Ukrainian strategy for the return of emigrants.

The strategy of the Ukrainian government for the return of emigrants was announced by the Prime Minister of Ukraine D. Shmyhal in early September 2024. As the head of government stated, “The idea of creating the Ministry for the Return of Emigrants is that we pay special attention to the 7.5 million Ukrainians who are currently outside our country”. According to him, this process should be organized, coordinated and has its own strategy [17]. However, the main guideline should be security [personal security] [18]. According to the President of Ukraine V. Zelensky, the issue of the return of most citizens to the territory of Ukraine directly depends on personal security [19].

However, it is obvious that security is not only a fragile increase in the safety of life in Ukrainian cities during the war, it is also the security of the individual in its social, medical, educational, vital, financial and other aspects. In this regard, there are significant differences between the European Union and Ukraine. Their content is determined by the state’s policy on ensuring human rights and freedoms. The issue of men of draft age who emigrated from Ukraine before the war and gained some experience of assimilation into the socio-cultural characteristics of the host country was of considerable importance in this matter.

It is too early to say that the government has a complete understanding of the problem of refugee return. Today, it is more likely that we are talking about

refugees as a factor of pressure on the government’s activities in general. There are also image risks for the country among European partners and fears of losing control over the country’s significant human resources which are desperately needed to restore the country after the end of the war.

According to experts, the government’s intentions in this extremely difficult task are facilitated by three circumstances.

The first is that, according to the latest data, 64 % of migrants from Ukraine have not adapted to life in other countries and intended to return home. According to the survey results, the greatest desire to return to Ukraine is expressed by migrants, who work remotely for Ukrainian businesses – 70 %. Similarly, the greatest desire to return to Ukraine is expressed by migrants, who are temporarily unemployed – 68 % for various reasons: education, profession, language skills, etc.

The second is that the desire to return to Ukraine is influenced by the level of aggressive behavior of citizens of host countries towards migrants. At least 23 % of respondents reported that they had a corresponding negative experience [16].

The third is that the choice of the option of returning to the country is facilitated by the change in rhetoric around the immigration problem on the part of European politicians and a part of the population of host countries. Thus, migration experts from the analytical center European Policy Centre Alberto-Horst Neidhardt says that “the rhetoric around the immigration problem is becoming tougher throughout Europe. In many EU countries there is an emergency situation with refugees. The prospect of further arrivals of people from Ukraine and other regions of the world will increase pressure on the authorities” [20]. The example of Poland is the most alarming signal in this regard. Thus, citing Euractiv, “European Truth” states that the number of Poles who believe that the country should accept Ukrainian refugees has fallen to 53 % which is the lowest figure since February 2022, when 94% of respondents said that they supported accepting refugees [21].

The concerns of Europeans have also been heightened by the circumstances of the “superposition of situations” with emigrants of different waves in time. The point is that in the period 2010-2020 EU countries have already received about 680,000 applications for asylum from citizens of Syria, Afghanistan and some African and Asian countries. This is 54 % more than in the same period of the previous year [20]. Thus, European hospitality is being replaced by fatigue and negativity towards those who arrive “ready for anything”. Today, Europeans are pressured by growing inflation, and state budgets lack funds for social payments to the local population. And this, as is known, is not only a question of social peace in the country. This is a question of the political well-being of local elites, and no political force in power is willing to risk it for the sake of Ukraine’s problems.

In contrast to the intentions of the Ukrainian government to return emigrants, there are also three circumstances that clearly dissonant with the previous indicators. That is, it is about “rejection” of oneself from one’s homeland and everything that is happening there.

The first circumstance is that a third of Ukrainian refugees who currently live in Germany, Poland and the Czech Republic are not at all interested in the events and situation in Ukraine. This is evidenced by the results of a survey by the Kyiv International Institute of Sociology. 34 % of Ukrainians directly indicated that they are not at all interested in information about Ukraine, and 11 % chose the answer option – “difficult to answer”. Such a tone is a signal of the gradual loss of connection with the country by some emigrants and the presence of alternative options for action among respondents [16].

The second is the uncertainty of the country's future – 35 %. Uncertainty about one's future and one's children is a push factor for relocation which has increased significantly over the past six months, when financial assistance from the United States was “paused”.

According to surveys (47 %), the factor of stability and the ability to plan for the future encourages Ukrainian migrants to consider the possibility of moving abroad for permanent residence [22]. The lack of prospects for a peaceful life in Ukraine is one of the three main push factors that will encourage Ukrainians to stay abroad or plan their departure from Ukraine. The number of respondents in the country who expect the war to drag on for years is 37 %. It is significant that among respondents abroad, the share of respondents who believe that the war will stretch for years is 42 % [22].

The third circumstance is the most sensitive and critical in the emigrant environment. This is the return to Ukraine of men of draft age (the so-called “evaders”) and their mobilization into the ranks of the armed forces in accordance with the requirements of martial law in Ukraine.

Here, attention should be paid to the statements of a number of high-ranking officials. According to the Minister of Defense R. Umerov and the head of the parliamentary faction of Ukraine “Servants of the People” D. Arakhamia, this issue should be resolved in a legal and legal manner with the governments of the countries where men of military age are staying on the basis of the law and through the mechanism of deportation [23]. According to the Minister of Justice of Ukraine D. Malyska, this path is too dubious. “Even in more obvious and blatant cases of crimes committed, for example, by top corruption figures”, the minister notes that “it is impossible to ensure extradition even for them. Courts (of European countries) are very cautious about extradition issues, in particular, due to the fact that we are at war” [23]. He is echoed by the executive director of the Ukrainian Helsinki Human Rights Union, O. Pavlichenko. He also believes that there is no mass legal opportunity to return citizens of military age [24].

The conclusion of the discussion can be considered the statement of the Secretary of the National Security and Defense Council O. Danilov which he made in January 2024. In his opinion, “the desire to forcibly return Ukrainian citizens liable for military service from abroad will not work” [25].

The topic of forced extradition of “evaders” was also actively picked up by the Western media. Already in January 2024 the reaction of the governments of the

EU countries to the “male evaders” was almost unanimous:

Austria: officially called the measure “an encroachment on our statehood”;

Estonia: Minister of the Interior Lauri Lainemets stated that the country would not “drive Ukrainian men to the front” [26];

Germany: Minister of Justice Marco Buschmann stated the following: “We will not force people to do military service or conscription against their will... We cannot force people from other countries to do this” [26];

Poland: The head of the parliamentary committee on foreign affairs Pawel Kowal confirmed that there will be no deportation of Ukrainian migrants, although they would like to create conditions for voluntary return [27];

Hungary: Deputy Prime Minister Zsolt Semyon stated the following: “We do not check refugees for suitability for military service. Hungary will not extradite them to Ukraine” [27];

Czech Republic: The Minister of Justice of the Czech Republic Vladimir Rzepka referred to the European Convention which excludes extradition for evasion of military service, desertion or disobedience to a command order [28].

The Center for Economic Strategy offers a look at the conditions for the return of refugees from European countries. According to the Center's experts, the main factors in the return of Ukrainians home are:

- safety;
- availability of housing to which they can return;
- the opportunity to earn a living;
- comparison of general living conditions at home and in the country of their stay [29].

In the socio-political space of Ukraine, there is another project for the return of refugees. This is the plan “Return of citizens temporarily displaced, in particular abroad and their integration into the socio-economic life of the state” which was developed in July 2022. The leitmotif of its content was the requirement – “adjacent to the EU policy which is implemented to manage the areas of migration, asylum, integration, border” which only in one case refers to some specifics [30, p. 35-36]. Despite the obsolescence of this document (almost two years) it has a number of provisions that should be taken into account in the issue of forced migration and its perception in society. Especially since this project was carried out on a state order where the key problem was related to the forecast of the return to peaceful life of 15 million people at the end of the war [30, p. 35].

The contradiction of this document is the authors' statement that “it does not require additional funding”, but at the same time two sources of funding are indicated: the state budget and the budget program under the KPKVK 3901000 (the apparatus of the Ministry for the Reintegration of the Temporarily Occupied Territories of Ukraine) [30, p. 35]. As critics of this document point out, such “strange discrepancies in the financing of the project can already be regarded as a loophole for corruption”. According to thoughts of experts, corruption as a problem of the return of forced migrants has not yet been mentioned, but it is at least a significant demotivator for the return of refugees to Ukraine [30, p. 35].

Conclusions

The dynamics and features of forced emigration of Ukrainians throughout modern history give grounds to draw several conclusions.

First, the problem of forced emigration from Ukraine should begin with an analysis of the state of the basic vital elements of the organization of the space of human existence in the country. They are clearly formulated in various international and national documents which are based on the UN Millennium Declaration (2000) and require national governments not only to profess “human rights and freedoms”, but also to ensure their fulfillment with certain opportunities and resources. First of all, this concerns the most vulnerable social groups of the population. In peacetime, forced emigration from Ukraine was caused, first of all, by economic factors and the desire of the most mobile part of the population to improve their standard of living. In wartime, by fleeing from war and the threats to life associated with it.

Second, the Ukrainian government’s intentions to return refugees to the country are hindered by the lack of a clear and substantiated strategy as a mobilization path and a component of a “grand strategy” as understood by the British historian Liddell Hart. It [the strategy] must be filled with a certain resource – financial, economic, social, humanitarian, etc. and be subordinated to a single plan. Taking into account national specifics, it must also reflect the forgotten spirit of social justice and the stages of the perspective of life in a democratic state where there are mechanisms of openness and accountability of the government to the people.

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