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Content

Economic sciences

THE WAYS TO REDUCE RISKS OF SMALL BUSINESS IN GEORGIA

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Abstract

Small business is developing dynamically in Georgia and faces many dangers of risk realization.

Liquidity risks of assets are relevant in small business, which can be defeated by implementing innovations and achieving rapid pace of technological development in this segment.

Small business of Georgia significantly depends on import. This situation should be changed through the growth of exported goods, in future.

It is important to gain the reputation of a reliable partner, for success of a small business, so minimizing reputational risks is the most important task of management.

The risk of competition is especially sensitive for small enterprises, because not only small enterprises, but also large market participants are often in competition with them.

Small business enterprises rarely apply for risk insurance in Georgia, which can be used to compensate losses.

It is necessary to create a clear vision of risk management, select and use the right risk managing strategy, for the stable development of small business.

აბსტრაქტი

საქართველოში მცირე ბიზნესი დინამიურად ვითარდება და აწყდება რისკების რეალიზაციის მრავალ საშიშროებას.

მცირე ბიზნესში აქტივების ლიკვიდობის რისკები აქტუალურია, რომლის დაძლევაც შესაძლებელია ამ სეგმენტში ინოვაციების დანერგვით და ტექნოლოგიური განვითარების სწრაფი ტემპების მიღწევით.

საქართველოს მცირე ბიზნესი მნიშვნელოვნად დამოკიდებულია იმპორტზე. მომავალში ეს მდგომარეობა უნდა შეიცვალოს საექსპორტო საქონლის ზრდის ხარჯზე.

მცირე ბიზნესის წარმატებისთვის მნიშვნელოვანია სანდო პარტნიორის რეპუტაციის მოპოვება, ამიტომ რეპუტაციული რისკების მინიმიზაცია მენეჯმენტის უმნიშვნელოვანესი ამოცანაა.

მცირე საწარმოებისათვის განსაკუთრებით სენსიტიურია კონკურენციის რისკი, ვინაიდან მათთან ხშირად კონკურენციაში იმყოფებიან არა მარტო მცირე საწარმოები, არამედ ბაზრის მსხვილი მონაწილეებიც.

საქართველოში მცირე ბიზნესის საწარმოები ნაკლებად მიმართავენ რისკების დაზღვევას, რომლის გამოყენებითაც შესაძლებელია ზარალების კომპენსაცია.

მცირე ბიზნესის სტაბილური განვითარებისათვის საჭიროა შეიქმნას რისკების მართვის მკაფიო ხედვა, შერჩეულ და გამოყენებულ იქნეს რისკების მართვის სწორი სტრატეგია.

Keywords: *small business, risks, asset liquidity, inflation, risk minimization, import, insurance.*

საკვანძო სიტყვები: მცირე ბიზნესი, რისკები, აქტივების ლიკვიდობა, ინფლაცია, რისკების მინიმიზაცია, იმპორტი, დაზღვევა.

Small business is one of the most dynamically growing segment of the economy in Georgia. The European integration process faced small businesses in front of a new challenges in Georgia. These challenges are related to the problems of minimizing the risks of integration and globalization. The involvement of small businesses of Georgia in the process of European integration creates new threats and at the same time strengthens probability of increasing the traditionally existing risks.

According to the data of the National Statistics Service of Georgia the share of small and medium-sized businesses in total turnover was 34.5% in 2022, while in 2015 it was only 18.1%. The main capital structure of small and medium-sized enterprises has changed, in the same period, if its share in the overall structure of the country's production potential was only 13.2% in 2015, in 2022 it was increased to 47.8%. This was caused by the fact that small business has become financially interesting for investments and the use of financial assets invested in this sphere is much more efficient.

Small and medium-sized businesses actively participate in solving the problem of unemployment in the country, if small and medium-sized businesses employed only 43.1% of the total employees in 2015, this figure was 60.1% in 2022.

Small businesses face many danger of risk realization in Georgia during their activity process, which belongs to the groups of speculative or pure risks due to their internal nature.

Liquidity risks of assets have become the "Achilles heel" of this activity in small businesses, due to the growing dynamics of inflation processes, which can be defeated by implementing innovations and achieving rapid pace of technological development in this segment of economy. Due to the geopolitical situation of Georgia, liquidity risks in small business are also significantly related to external factors, namely: the problem of territorial integrity, ongoing military conflicts in Georgia's neighboring countries, changes in the country's legislation, economic crises, unfair competition, inflation, currency devaluation, and others. Internal liquidity risks of small enterprises are mainly related to faulty management, wrong monetary credit policy and wrong business strategy and tactics in Georgia.

Traditionally, one of the most sensitive risks in small business enterprises is the increase of cost of resources, due to the scarcity of financial resources. The magnitude and frequency of these risks are determined by the increase of prices on natural, energy and human resources, in domestic and foreign markets.

Small businesses significantly depend on imports and the cost of imported materials and semi-finished products in Georgia, like the whole country. From January to November of 2023 turnover of foreign trade with goods (without undeclared trade) amounted 19,612.8 million US dollars in Georgia, in which export amounted 5,584.3 million US dollars, and import to 14,028.5 million US dollars. Negative trade balance of Georgia from January to November of 2023 amounted 8,444.2 million US dollars, which is 43.1 percent of foreign trade turnover.

We think that in future this undesirable situation should be changed due to growth of exported goods, like in small businesses, also in whole country, following the economic development of Georgia.

The danger of realization of technological risks is also high, in small businesses, since there are many difficulties associated with the introduction of innovations and the technological perfection. Nowadays, significant investments are being made with the help of startups and various governmental and non-governmental programs, in this segment of economy in Georgia.

The European Union supports the development of small and medium-sized businesses in Georgia. Through the EU4Business program, up to 50 different projects were operating in the country at different times, which total budget exceeded 320 million euros. The European Union is the largest donor and

supporter of private sector development in Georgia. These efforts have already brought significant results – in 2019, more than 36,000 small and medium-sized businesses were supported in Georgia, as a result 30,000 new jobs and up to 400 million euros of additional income was created.

It is important to gain the reputation of a reliable partner, for success of a small business, so minimizing reputational risks is the most important task of management.

The risk of competition is especially sensitive for small enterprises, because of not only small enterprises, but also large market participants are often in competition with them.

First of all, small businesses should minimize such financial risks which are related to the growth of costs, violation of contractual conditions, taking immature and unsubstantiated financial obligations, providing low-quality products and services to customers, reputational damage, and etc. due to limited financial opportunities. This is possible only when the strategy and tactics of risk management in small business are consistent with the business environment and the changes that are related to the development of this enterprise.

In order to neutralize financial risks in small enterprise, it is necessary to develop measures that completely exclude high-risk financial transactions with suppliers and customers who systematically violate contractual obligations and other agreements. Also, those small enterprises who want to have a modern level of financial management should create risk concentration limits, which should include those financial operations that belong to the critical level of risks. That is often impossible in small enterprises, but if it is possible, an effective mechanism for minimizing risks will be their diversification, which implies a rational redistribution of expected risks.

Unfortunately, in order to save financial resources, small business enterprises rarely use risk insurance in Georgia. However, insurance is an effective risk managing mechanism, which provides material compensation of losses. Small entrepreneur will protect his property, health of his employees by insurance, also will be protected from the costs caused by damaging other people's property and health due to his fault.

In order to maintain a stable development, it is necessary to create a clear vision of risk management in a small business enterprise. The formation of such visions is complicated by the multitude of operational problems in these enterprises, and it is impossible to create a risk management service or hire a qualified risk manager due to the lack of financial resources.

According to the law of Georgia "about competition", the competition agency must identify the facts of restriction of competition and unfair competition and protect small and medium-sized enterprises from the dictates of big business, by detecting "cartel" agreements against small and medium-sized businesses, limiting them and protecting the interests of consumers. This institution should become one of the important institutions for strengthening antimonopoly activities in the country, in future.

The development of small and medium-sized businesses is significantly prevented in the modern world by the danger of merging and absorbing small business objects by large businesses, which is motivated by the desire of corporations to grow, accumulate capital and reorganize. In such a case, the shareholders mainly focus on the growth of the shareholder's capital and using the mechanisms favorable to them, they try to carry out a specific action of merger or absorption in order to increase their own assets and opportunities on the markets.

The strategy of risk management in small business and the effectiveness of this strategy should be evaluated from three main positions, which are: the impact of shareholders' investment portfolios on common risks, the sensitivity to risks of the business environment, and the condition of liquidity of assets in case of realization of existing risks.

Innovative entrepreneurs do not run away from difficulties in Georgia and, they do not lose their professional interest in developing their business due to the difficulties created in business. As for the encouragement and financing of innovative activities by the government, we think that it is necessary to increase the volume of financing startup programs, increase the targeting and more support and promotion of innovative ideas by the government.

The European experience and practice of attracting venture investments in small and medium-sized businesses is still less used in Georgia, but venture capital is the resource that should give a push to the production of innovative products in this field and the integration of this business segment with the EU markets.

There is opinion in business circles in Georgia that in order to minimize risks in small business, it is necessary to create a special program. Purpose of this program will be the prevention of risks in small business. We believe that the existence of such a program will cause over-administration the activities of

small businesses and restrict their freedom. Small enterprises should be able to maintain a balance in risk management, naturally maintain the ability to be creative, overcome the difficulties and contradictions associated with risk management in small enterprises by their own efforts.

At the same time, we think that it is necessary that business associations systematically conduct seminars and trainings for small businesses on issues related to risk management, because the knowledge of risk management is an advantage that will definitely be manifested in the possibility of minimizing risks.

საქართველოში მცირე ბიზნესი ეკონომიკის ერთ - ერთი ყველაზე დინამიურად მზარდი სეგმენტია. ევროინტეგრაციის პროცესმა საქართველოში მცირე ბიზნესი დააყენა ახალი გამოწვევების წინაშე. ეს გამოწვევები ინტეგრაციის და გლობალიზაციის რისკების მინიმიზაციის პრობლემებს უკავშირდება. საქართველოს მცირე ბიზნესის ჩართულობა ევროინრეგრაციის პროცესში აჩენს ახალ საფრთხეებს და ამავე დროს აძლიერებს ტრადიციულად არსებული რისკების ზრდის ალბათობასაც.

საქართველოს სტატისტიკის ეროვნული სამსახურის *2022* წლის მონაცემებით, მცირე და საშუალო ბიზნესის წილმა საერთო ბრუნვაში შეადგინა *34,5%*, მაშინ, როცა *2015* წელს ის შეადგენდა მხოლოდ *18,1%* - ს. ამავე პერიოდში შეიცვალა მცირე და საშუალო საწარმოთა ძირითადი კაპიტალის სტრუქტურა. თუ მისი წილი ქვეყნის საწარმოო პოტენციალის საერთო სტრუქტურაში *2015* წელს შეადგენდა მხოლოდ *13.2%* - ს, *2022* წელს იგი გაიზარდა *47.8%* - მდე. ეს შესაძლებელი გახადა იმან, რომ მცირე ბიზნესი ინვესტიციებისთვის გახდა ფინანსურად საინტერესო და ამ სფეროში დაბანდებული ფინანსური აქტივების გამოყენება ბევრად უფრო ეფექტურია.

მცირე და საშუალო ბიზნესი აქტიურად მონაწილეობს ქვეყანაში უმუშევრობის დაძლევის პრობლემის მოგვარების საქმეშიც, თუ *2015* წელს მცირე და საშუალო ბიზნესმა დაასაქმა საერთო დასაქმებულთა მხოლოდ *43,1%*, *2022* წელს ამ მაჩვენებელმა შეადგინა *60.1%*.

საქართველოში მცირე ბიზნესი თავისი საქმიანობის პროცესში აწყდება რისკების რეალიზაციის მრავალ საშიშროებას, რომლებიც თავისი შინაგანი ბუნებიდან გამომდინარე მიეკუთვნება სპეკულაციურ ან სუფთა რისკების ჯგუფებს.

მცირე ბიზნესში აქტივების ლიკვიდობის რისკები ინფლიაციის პროცესების მზარდი დინიმიკიდან გამომდინარე გახდა ამ საქმიანობის ,,აქილევსის ქუსლი,'' რომლის დაძლევაც შესაძლებელია ეკონომიკის ამ სეგმენტში ინოვაციების დანერგვით და ტექნოლოგიური განვითარების სწრაფი ტემპების მიღწევით. საქართველოს გეოპოლიტიკური მდგომარეობიდან გამომდინარე, მცირე ბიზნესში ლიკვიდობის რისკები, ასევე მნიშვნელოვანწილად დაკავშირებულია გარე ფაქტორებთანაც, კერძოდ: ტერიტორიული მთლიანობის პრობლემასთან, საქართველოს მეზობელ ქვეყნებში მიმდინარე სამხედრო კონფლიქტებთან, ცვლილებებთან ქვეყნის კანონმდელობაში, ეკონომიკურ კრიზისებთან, არასამართლიან კონკურენციასთან, ინფლიაციასთან, ფულის დევალვაციასთან და სხვა. საქართველოში მცირე საწარმოთა ლიკვიდობის შიდა რისკები კი ძირითადად დაკავშირებულია გაუმართავ მენეჯმენტთან, არასწორ ფულად საკრედიტო პოლიტიკასთან და საქმის გაძღოლის არასწორ სტრატეგიასა და ტაქტიკასთან.

ტრადიციულად, ფინანსური რესურსების სიმცირის გამო, მცირე ბიზნესის საწარმოებში ერთ - ერთი ყველაზე სენსიტიური რისკია რესურსების ღირებულების ზრდა. ამ რისკების სიდიდეს და სიხშირეს, როგორც შიდა ასევე გარე ბაზრებზე განსაზღვრავს ბუნებრივი, ენერგეტიკული და ადამიანურ რესურსებზე ფასების ზრდა.

საქართველოს მცირე ბიზნესი, ისევე როგორც მთლიანად ქვეყანა, მნიშვნელოვნად დამოკიდებულია იმპორტზე და იმპორტული მასალებისა და ნახევარფაბრიკატების ღირებულებაზე. *2023* წლის იანვარ - ნოემბერში საქართველოში საქონლით საგარეო სავაჭრო ბრუნვამ *(არადეკლარირებული ვაჭრობის გარეშე) 19 612.8* მილიონი აშშ დოლარი შეადგინა, აქედან ექსპორტი *5 584.3* მილიონი აშშ დოლარს შეადგენს, ხოლო იმპორტი *14 028.5* მილიონ აშშ

დოლარს. საქართველოს უარყოფითმა სავაჭრო ბალანსმა *2023* წლის იანვარ - ნოემბერში *8 444.2* მილიონი აშშ დოლარი შეადგინა, რაც საგარეო სავაჭრო ბრუნვის *43.1* პროცენტია.

ვფიქრობთ, რომ მომავალში საქართველოს ეკომომიკური განვითარების კვალდაკვალ, ეს არასასურველი მდგომარეობა უნდა შეიცვალოს საექსპორტო საქონლის ზრდის ხარჯზე, როგორც მცირე ბიზნესში, ასევე მთლიანად ქვეყნის მაშტაბით.

მცირე ბიზნესში ასევე მაღალია ტექნოლოგიური რისკების რეალიზაციის საფრთხე, ვინაიდან ინოვაციების დანერგვას და წარმოების ტექნოლოგიურ სრულყოფას ბევრი სირთულე უკავშირდება. დღეს საქართველოში ეკონომიკის ამ სეგმენტში სტარტაპებისა თუ სხვადასხვა სამთავრობო და არასამთავრობო პროგრამების მეშვობით, მნიშვნელოვანი ინვესტიციები ხორციელდება.

ევროკავშირი მხარს უჭერს საქართველოში მცირე და საშუალო ბიზნესის განვითარებას. *EU4Business* პროგრამის მეშვეობით სხვადასხვა დროს ქვეყანაში მოქმედებდა *50* - მდე სხვადასხვა პროექტი, რომელთა საერთო ბიუჯეტმა *320* მილიონ ევროს გადააჭარბა. ევროკავშირი საქართველოში კერძო სექტორის განვითარების უმსხვილესი დონორი და მხარდამჭერია. ამ ძალისხმევამ უკვე მოიტანა მნიშვნელოვანი შედეგები – მხოლოდ *2019* წელს, საქართველოში *36 000* - ზე მეტი მცირე და საშუალო ბიზნესის მხარდაჭერა განხორციელდა, რის შედეგადაც *30 000* ახალი სამუშაო ადგილი და *400* მილიონ ევრომდე დამატებითი შემოსავალი შეიქმნა.

მცირე ბიზნესის წარმატებისთვის უაღრესად მნიშვნელოვანია სანდო პარტნიორის რეპუტაციის მოპოვება, ამიტომ რეპუტაციული რისკების მინიმიზაცია ან მათი სრული ნეიტრალიზაცია მენეჯმენტის უმნიშვნელოვანესი ამოცანაა.

კონკურენციის რისკი მცირე ბიზნესში განსაკუთრებით სენსიტიურია, ვინაიდან მასთან ხშირად კონკურენციაში იმყოფება არ მარტო მცირე საწარმოები, არამედ ბაზრის მსხვილი მონაწილეებიც.

მცირე ბიზნესი შეზღუდული ფინანსური შესაძლებლობიდან გამომდინარე, პირველ რიგში უნდა ახდენდეს ისეთი ფინანსური რისკების მინიმიზაციას, რომლებიც დაკავშირებულია დანახარჯების ზრდასთან, სახელშეკრულებო პირობების დარღვევასთან, გაუაზრებელ და დაუსაბუთებელ საფინანსო ვალდებულებების აღებასთან, მომხმარებელზე დაბალი ხარისხის პროდუქციის და მომსახურების მიწოდებასთან, რეპუტაციულ ზიანთან და სხვა. ეს კი შესაძლებელია მხოლოდ მაშინ, როდესაც რისკების მართვის სტრატეგია და ტაქტიკა მცირე ბიზნესში შესაბამისობაშია ბიზნეს გარემოსთან და იმ ცვლილებებთან, რაც უკავშირდება ამ საწარმოს განვითარებას.

მცირე საწარმოში ფინანსური რისკების ნეიტრალიზაციის მიზნით, აუცილებელია ისეთი ღონისძიებების შემუშავება, რომელიც მთლიანად გამორიცხავს მაღალი რისკის მქონე ფინანსურ ოპერაციებს იმ მომწოდებლებთან და მომხმარებლებთან, რომლებიც სისტემატიურად არღვევენ სახალშეკრულებო ვალდებულებებს და სხვა შეთანხმებებს. ასევე იმ მცირე საწარმოებმა, რომლებსაც სურთ ჰქონდეთ თანამედროვე დონის ფინანსური მენეჯმენტი, უნდა შექმნან რისკების კონცენტრაციის ლიმიტები, რომლებშიც უნდა მოექცეს ის ფინანსური ოპერაციები, რომლებიც რისკების კრიტიკულ დონეს განეკუთნება. რაც მცირე საწარმოებში ხშირად შეუძლებელია, მაგრამ თუ ეს მოხერხდა, რისკების მინიმიზაციის ეფექტური მიქანიზმი იქნება მათი დივერსიფიკაცია, რაც გულისხმობს მოსალოდნელი რისკების რაციონალურ გადანაწილებას.

სამწუხაროდ ფინანსური რესურსების დაზოგვის მოტივით, საქართველოში მცირე ბიზნესის საწარმოები ნაკლებად მიმართავენ რისკების დაზღვევას. არა და დაზღვევა რისკების მართვის ის ეფექტური მექანიზმია, რომლის გამოყენებაც უზრუნველყოფს ზარალების მატერიალურ კომპენსაციას. დაზღვევით მცირე მეწარმე დაიცავს საკუთარ ქონებას, დასაქმებულების ჯანმრთელობას, ასევე დაცული იქნება თავისი ბრალეულობით სხვისი ქონების და ჯანმრთელობის დაზიანებისგან გამოწვეული ხარჯებისაგან.

იმისათვის, რომ შევინარჩუნოთ სტაბილური განვითარება, საჭიროა მცირე ბაზნესის საწარმოში შეიქმნას რისკების მართვის მკაფიო ხედვა. ასეთი ხედვების ჩამოყალიბებას

ართულებს ამ საწარმოებში ოპერატიული პრობლემების სიმრავლე, ხოლო ფინანსური რესურსების სიმცირის გამო, ვერ ხერხდება რისკების მართვის სამსახურის შექმნა ან კვალიფიციური რისკ მენეჯერის დაქირავება.

საქართველოს კანონის ,,კონკურენციის შესახებ'' თანახმად, კონკურენციის სააგენტომ უნდა გამოავლინოს კონკურენციის შეზღუდვისა და არაკეთილსინდისიერი კონკურენციის ფაქტები და მცირე და საშუალო საწარმოები დაიცვას მსხვილი ბიზნესის დიქტატისაგან. მცირე და საშუალო ბიზნესის წინააღმდეგ ,,კარტელური'' შეთანხმებების გამოვლენით, მათი შეზღუდვით და მომხმარებელთა ინტერესების დაცვით. ეს სამსახური მომავალში უნდა გახდეს ერთ-ერთი მნიშვნელოვანი ინსტიტუტი ქვეყანაში ანტიმონოპოლიური საქმიანობის გასაძლიერებლად.

თანამედროვე მსოფლიოში მცირე და საშუალო ბიზნესის განვითარებას მნიშვნელოვნად აფერხებს მსხვილი ბიზნესის მხრიდან მცირე ბიზნეს ობიექტების შერწყმისა და შთანთქმის საშიშროება, რაც მოტივერებულია კორპორაციათა ზრდის, კაპიტალის აკუმულირებისა და რეორგანიზაციის სურვილით. ასეთ შემთხვევაში აქციონერები ძირითადად ფოკუსირებულნი არიან აქციონერული კაპიტალის ზრდაზე და მათთვის ხელსაყრელი მექანიზმების გამოყენებით ცდილობენ განახორციელონ შერწყმისა თუ შთანთქმის კონკრეტული მოქმედება, რათა ამ გზით ბაზრებზე გაზარდონ საკუთარი აქტივები და შესაძლებლობები.

მცირე ბიზნესში რისკების მართვის სტრატეგია და ამ სტრატეგიის ეფექტიანობა უნდა ფასდებოდეს სამი ძირითადი პოზიციდან, რაც არის: აქციონერთა ინვესტიციური პორთფელების გავლენა საერთო რისკებზე, ბიზნეს გარემოს რისკებისადმი სენსიტიურობა და არსებული რისკების რეალიზაციის შემთხვევაში აქტივების ლიკვიდობის მდგომარეობა.

საქართველოში ინოვაციური მეწარმეები არ გაურბიან სირთულეებს და რაც მთავარია, ბიზნესში შექმნილი სირთულეების გამო არ კარგავენ საკუთარი ბიზნესის განვითარების პროფესიულ ინტერესს. რაც შეეხება მთავრობის მხრიდან ინოვაციური აქტიურობების წახალისებას და დაფინანსებას, ვფიქრობთ, რომ საჭიროა მთავრობის მხრიდან სტარტაპების პროგრამების დაფინანსების მოცულობების გაზრდა, მიზნობრიობის ამაღლება და ინოვაციური იდეების მეტი მხარდაჭერა და პოპულარიზაცია.

მცირე და საშუალო ბიზნესში ვენჩერული ინვესტიციების მოზიდვის ევროპული გამოცდილება და პრქტიკა ჯერჯერობით საქართველოში ნაკლებად გამოიყენება, არადა სწორედ ვენჩერული კაპიტალია ის რესურსი, რომელმაც უნდა მისცეს ბიძგი ამ სფეროში ინოვაციური პროდუქტების წარმოებას და ბიზნესის ამ სეგმენტის ევროკავშირის ბაზრებთან ინტეგრაციას.

საქართველოში ბიზნეს წრეებში გამოითქმის მოსაზრება, რომ მცირე ბიზნესში რისკების მინიმიზაციის მიზნით საჭიროა შეიქმნას სპეციალური პროგრამა, რომლის დანიშნულებაც იქნება მცირე ბიზნესში რისკების პრევენცია. ვფიქრობთ, რომ ასეთი პროგრამის არსებობა მოახდენს მცირე ბიძნესის საქმიანობის ზედმეტად ადმინისტრირებას და მათი თავისუფლების შეზღუდვას. მცირე საწარმოებმა თვითონ უნდა მოახერხონ რისკების მართვაში წონასწორობის ბალანსის დაცვა, ბუნებრივად შეინარჩუნონ კრეატიული საქმიანობის უნარი, საკუთარი ძალებით დაძლიონ ის სირთულეები და წინააღმდეგობები, რომლებიც მცირე საწარმოებში რისკების მენეჯმენტს უკავშირდება.

ამავე დროს ვფიქრობთ, რომ საჭიროა ბიზნეს ასოციაციებმა მცირე ბიზნესისთვის სისტემატიურად ჩაატარონ რისკების მართვასთან დაკავშირებულ საკითხებზე სემინარები და ტრენინგები, რადგან რისკების მართვის ცოდნა არის ის უპირატესობა, რომელიც აუცილებლად გამოვლინდება მათი მინიმიზაციის შესაძლებლობაში.

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Jurisprudence

THE ROLE OF AUXILIARY BODIES OF THE LEGISLATIVE AND EXECUTIVE AUTHORITIES IN THE CREATION OF THE EUROPEAN MANAGEMENT-PARTICIPATORY PARADIGM OF DEMOCRATIC LEGISLATION: TOWARDS THE CONSTRUCTION OF A CONCEPTUAL MODEL

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РОЛЬ ДОПОМІЖНИХ ОРГАНІВ ЗАКОНОДАВЧОЇ ТА ВИКОНАВЧОЇ ВЛАДИ У СТВОРЕННІ ЄВРОПЕЙСЬКОЇ УПРАВЛІНСЬКО-ПАРТИСИПАТОРНОЇ ПАРАДИГМИ ДЕМОКРАТИЧНОЇ ЗАКОНОТВОРЧОСТІ: ДО ПОБУДОВИ КОНЦЕПТУАЛЬНОЇ МОДЕЛІ

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Abstract

The article is devoted to the study of the conceptual model of the role of auxiliary bodies of the legislative and executive authorities in the creation of a European management-participatory paradigm of democratic law-making, which is enshrined in the Guidelines / principles / on democratic law-making for better laws developed by the OSCE in 2023.

It is proven that the Guidelines / principles / on democratic law-making for better laws, which were developed within the framework of the OSCE in 2023, are a significant example of the latest codification- integrated activity in the most important sphere of the existence and functioning of statehood, including the issue of logistical support and provision of the legislative process. Such principles affect both law-making and actual law-making, they have a significant democratic

potential, because they are aimed at involving a wide range of subjects in law-making, starting from the authorized bodies of public power (legislative, executive, judicial), their auxiliary bodies, and ending with the involvement broad sections of the population, as well as civil society institutions representing their various interests.

It is argued that auxiliary bodies of parliaments and governments actually organize, accompany and ensure their activities in the law-making process. The guidelines given in the Guidelines are actually the first attempt to codify within the framework of the OSCE the role and importance of auxiliary bodies of the legislative and executive power in the law-making process, which will contribute to their active borrowing and use by the member states of this and other international European organizations of the integration type.

A comparative legal analysis of the guidelines given in the Guidelines regarding the role of auxiliary bodies of public authority in the law-making process and provisions regarding the legal status of consultative, advisory and other auxiliary bodies of public authority in Ukraine shows the general compliance with the latest guidelines of the Guidelines in the relevant field.

Анотація

Стаття присвячена дослідженню концептуальної моделі ролі допоміжних органів законодавчої та виконавчої влади у створенні європейської управлінсько-партисипаторної парадигми демократичної законотворчості, що закріплена у Керівних вказівках /принципах/ щодо демократичної законотворчості для кращих законів, які розроблені ОБСЄ у 2023 році.

Доводиться, що Керівні вказівки /принципи/ щодо демократичної законотворчості для кращих законів, які розроблено в межах ОБСЄ у 2023 році, виступають суттєвим прикладом новітньої кодифікаційно-інтегрованої діяльності у найважливішій сфері існування та функціонування державності, включаючи й проблематику логістичного супроводження і забезпечення законодавчого процесу. Такі принципи торкаються як законопроєктування, так й власне законотворчості, вони мають суттєвий демократичний потенціал, бо скеровані на залучення до законотворчості широкого кола суб'єктів, починаючи від уповноважених органів публічної влади (законодавчої, виконавчої, судової), їх допоміжних органів, і закінчуючи залученням широких верств населення, а також інституцій громадянського суспільства, що уособлюють їх різні інтереси.

Аргументується, що допоміжні органи парламентів та урядів фактично організують, супроводжують та забезпечують їх діяльність у законотворчому процесі. Наведені в Керівних принципах настанови є фактично першою спробою кодифікації в межах ОБСЄ ролі і значення допоміжних органів законодавчої та виконавчої влади в законотворчому процесі, що буде сприяти їх активному запозиченню та використанню державами-членами цієї та інших міжнародних європейських організацій інтеграційного ґатунку.

Порівняльно-правовий аналіз наведених в Керівних принципах настанов відносно ролі допоміжних органів публічної влади в законотворчому процесі та положень щодо правового статусу консультативних, дорадчих та інших допоміжних органів публічної влади в Україні свідчить про загальну відповідність останніх настановам Керівних принципів в профільній сфері.

Keywords: *law-making process, law-making, law-making, legal status of subjects of the law-making process, public authorities, auxiliary bodies of public authorities.*

Ключові слова: *законотворчий процес, законотворення, законопроєктування, правовий статус суб'єктів законотворчого процесу, органи публічної влади, допоміжні органи органів публічної влади.*

Вступ

Демократична правова державність виступає не тільки телеологічною домінантою, а й відповідним зразком сучасного локального, регіонального, національного розвитку всередині конкретної держави, а й важливим прикладом субрегіонального, макрорегіонального розвитку, а також розвитку міжнародного співтовариства держав, члени якого пов'язані відповідними міжнародними правовими зобов'язаннями (стандартами) у сфері розвитку державно-правових

інституцій, правових систем, правового статусу людини і громадянина тощо. Важливим і стратегічним тригером в цьому процесі відіграє феномен законотворчості.

Отже, законотворчість, а точніше законотворення (законопроєктування + законотворчість) є одним з основних функціонально-діяльнісних напрямків діяльності держави, ефективність якого:

а) є об'єктивно та абсолютно необхідною передумовою належного, передбаченого, телеологічно обґрунтованого та проспективного розвитку держави та суспільства,

б) становлення держави як конституційної та правової, а також

в) формування, реалізації, розвитку і вдосконалення правового статусу людини (особистості, громадянина).

Звідси, належне наукове, організаційне, методологічне, дидактичне та нормативне забезпечення законотворчого процесу як багаторівневої, багатоаспектної, багатооб'єктної та багатосуб'єктної феноменології, що реалізується у відповідній стадійно-етапній та процесуально-процедурній парадигмі, – є стратегічно-важливим завданням розвитку держави, адже тільки врахування актуальних, комплексних та цілісних наукових, організаційно-методологічних та дидактичних розробок, теорій та поглядів дозволить не тільки вивести законодавчий процес в Україні на високий рівень, а й забезпечити йому належне нормативно-правове супроводження і забезпечення. Як слушно стверджує вітчизняний дослідник В. Гончаренко, «лише ретельно відпрацьоване на засадах верховенства права і сучасної правової науки та інших суспільних і природничих наук законодавство може бути надійною основою для прогресивного розвитку особи, суспільства і держави» [1, с. 42]. Отже, йдеться не тільки про:

а) дотримання основоположних принципів права і інших соціальних наук в процесі розробки законодавства (фактор засадничого та науково-доктринального забезпечення законодавства через законотворення – авт.)

б) органічний зв'язок між законотворчим процесом та його належним та ефективним супроводженням і забезпеченням у різних сферах (фактор процесуально-процедурного забезпечення законодавства через законотворення – авт.), а й про

б) подальший розвиток основоположного суб'єктного складу організації та функціонування інституційної основи державності, суттєве вдосконалення соціально-нормативних відносин між такими суб'єктами в інтересах як людини, її груп та асоціацій, так й державно-правових інститутів, що забезпечують її подальший демократичний розвиток та його вдосконалення (фактор супроводження і забезпечення правового статусу особи, суспільства і держави в національному законодавстві через законотворення – авт.).

Саме тому правова наука не тільки покликана і в змозі не лише аналізувати сучасний стан правової системи України (аналітичний фактор законотворення – авт.), – а й прогнозувати її подальший розвиток (прогностичний фактор законотворення – авт.), враховуючи досвід зарубіжних держав та вплив світових та європейських інтеграційних процесів (міжнародно-стандартизований фактор законотворення – авт.). Саме тому ефективність та якість законодавства залежить у великій мірі не тільки від його відповідності положенням правової доктрини (доктринальний фактор законотворення – авт.), а й виконання відповідних організаційно-технологічних настанов організації, супроводження і забезпечення структурно-стадійних характеристик законотворення – законопроєктування та законотворчості (технологічний фактор законотворення – авт.).

Отже, наведене вище не тільки зумовлює об'єктивацію та актуалізацію необхідності проведення комплексного наукового дослідження стану наукового, інституційного, організаційного, методологічного, кадрового, технологічного та нормативного забезпечення законотворчого процесу в континентальній правовій системі та шляхів його вдосконалення, а й контекстуалізацію саме загальноєвропейського ставлення для цього виду процесуального забезпечення цього важливого аспекту функціонування державності (системно-комплексний та компаративний фактори законотворення – авт.). Серед наведених напрямків наукового дослідження особливу ініціюючу, організуючу, супроводжуючу, моделюючу, експертну, забезпечуючу роль відіграють інституційний та кадровий напрямки, бо саме через них стає відомим та ідентифікується коло суб'єктів та інституцій, що напряму або опосередковано беруть участь у законотворенні. Метою цієї статті є дослідження процесів побудови концептуальної моделі відносно ролі допоміжних органів законодавчої та виконавчої влади у створенні європейської управлінсько-партисипаторної парадигми демократичної законотворчості.

Стан дослідження проблематики ролі допоміжних органів вищих органів влади

Дослідження проблемних питань правового регулювання нормопроєктної (законопроєктної) та нормотворчої (законотворчої) діяльності – тобто, законотворення в конституційному праві на сучасному етапі суспільного розвитку проводили вітчизняні та зарубіжні фахівці у галузі адміністративного та конституційного права, теорії держави та права, серед яких варто відмітити праці В. Б. Авер'янова, О. Ф. Андрійко, Г. В. Атаманчука, М. О. Баймуратова, О. М. Бандурки, Д. М. Бахраха, Д. М. Белова, Ю. П. Битяка, С. Бошно, С. Н. Братуся, М. М. Бурбики, Ю. О. Волошина, Л. К. Воронової, В. М. Гаращука, В. К. Гіжевського, Є. А. Гетьмана, І. П. Голосніченка, В. Гончаренка, С. М. Гусарова, Т. О. Дідича, Є. В. Додіна, М. Дюверже, В. В. Зуй, Є. Євграфової, Р. А. Калюжного, В. Косовича, Девіда П. Каррі, С. В. Ківалова, В. М. Косовича, Л. Т. Кривенко, В. В. Копєйчикова, В. О. Котюка, М. А. Крутоголова, Є. В. Курінного, В. М. Марчука, О. М. Музичука, В. Я. Настюка, Л. В. Ніколаєвої, Н. Р. Нижник, М. П. Орзіх, Ю. М. Перерви, О. В. Петришина, В. П. Пєткова, Т. Подорожної, В. М. Поповича, Н. Ю. Пришви, П. М. Рабіновича, Н. О. Сахарова, О. Ф. Скакун, С. Г. Стеценка, В. П. Чабана, Р. В. Чорнолуцького, В. О. Шамрая, В. М. Шаповала, О. О. Шевченка, Ю. С. Шемшученка, І. М. Шопіної, І. Д. Шутака, О. І. Ющика та ін.

Дослідження проблематики удосконалення конституційно-правового регулювання діяльності інституційного та суб'єктного складу законотворчого процесу, включаючи й допоміжні органи при вищих органах державної влади, оптимізації їх системи та структури, визначення способів конституювання таких органів, що є важливими завданнями сучасної конституційно-правової науки здійснювалась в роботах таких учених, як Ю. Г. Барбаш, Я. О. Берназюк, О. Т. Волощук, А. З. Георгіца, П. С. Гончарук, В. Д. Горобець, Г. В. Дєгтєв, С. О. Дмитрієв, І. І. Драхова, Т. В. Закупень, О. М. Осавелюк, С. В. Осауленко, А. О. Панов, О. В. Перепелиця, І. М. Петрів, Д. М. Петровський, Н. Г. Плахотнюк, М. М. Пригон, М. В. Развадовська, Н. О. Рибалка, В. І. Розвадовський, М. В. Савчин, С. Г. Серьогіна, О. В. Совгиря, В. В. Сухонос, К. В. Тарасенко, О. С. Тарасов, М. К. Топоркова, В. Л. Федоренко, М. Ф. Хараджиєв, В. І. Цоклан, С. О. Чикурлій, В. А. Шатіло, В. І. Шевелєв, О. В. Щіпанов, В. В. Шутович, та інших.

Актуальність теми обумовлюється також відсутністю глибоких, комплексних досліджень наведеної проблематики, відповідної монографічної літератури, що ще раз свідчить як про її складність, так і про недостатню увагу до неї вчених-правознавців. Треба зазначити, що на сьогодні більшість питань, пов'язаних з удосконаленням конституційно-правового регулювання діяльності допоміжних органів при вищих органах державної влади, не розроблені, звідси, відповідно, залишились невирішеними широке коло проблем теоретичного, організаційного і правового характеру. А це набуває особливого значення в умовах проведення конституційної, судової, адміністративної, муніципальної реформ в державі. Крім того, треба враховувати, що поза увагою науковців залишилося й дослідження особливостей наукового забезпечення законотворчого процесу в континентальній правовій системі, особливо в аспектах запозичення та втілення міжнародного, в тому числі й європейського досвіду законотворення.

Об'єктивізація і актуалізація феноменології законотворення в Європі

Становлення, розвиток та вдосконалення феноменології правової демократичної державності напряму пов'язано з якісною, ефективною та продуктивною законопроєктною та законотворчою діяльністю, що організує, здійснює та реалізує кожна з держав Європи, що як суверенні та незалежні суб'єкти міжнародного права виступають на міжнародній арені. Особливо це спостерігається у діяльності європейських міждержавних інтеграційних об'єднаннях, де законотворення також займає одно з найважливіших напрямків спільної діяльності, в контекстуалізації принципу наднаціональності та створення самостійного блоку нормативно-правових актів, що мають законодавчий статус. Отже, в обов'язковому порядку треба враховувати й той факт, що більшість з них одночасно є державами-членами міжнародних міждержавних політичних, військово-оборонних, інтеграційних об'єднань (ОБСЄ, НАТО, Рада Європи, Європейський Союз тощо).

Саме цей факт є об'єктивно існуючим, визначальним та володіє пріоритетом в цьому системно-комплексному питанні, – і саме він об'єктивує, актуалізує та контекстуалізує проблематику уніфікації законопроєктної та законотворчої діяльності держав-членів наведених організацій, що детермінує розробку загальних підходів до законотворення (законопроєктування + законотворчість) через розробку відповідних документів методологічної, організаційної, логістично-діяльнісної та лапідарної властивості.

Отже, виходячи з наведеного вище:

- по-перше, йдеться про відповідну філософію законотворення, що повинна характеризуватися відповідною уніфікованістю та ефективністю;

- по-друге, йдеться про відповідне формування управлінсько-технологічного та управлінсько-процесуального супроводження і забезпечення цього процесу в межах загальної управлінської парадигми;

- по-третє, йдеться й про відповідний та високий рівень технологічності профільних настанов щодо законотворення, що:

а) суттєво підвищить рівень юридичної техніки;

б) гарантовано буде вести до прийняття якісних нормативно-правових актів, що

в) будуть адекватно відображати не тільки наявний, а й перспективний рівень регламентації та регулювання суспільних відносин,

г) викликаючи необхідний соціальний результат через сприяння соціальному розвитку; по-четверте, наведені дії повинні відбуватися у суворій послідовності, що передбачена відповідними процесуальними настановами нормативної або законодавчої властивості.

Саме до кола таких документів відносяться Guidelines on Democratic Lawmaking for Better Laws (Керівні вказівки /принципи/ щодо демократичної законотворчості для кращих законів) [2] (далі – Керівні принципи), що були розроблені з ініціативи та під егідою Бюро демократичних інститутів та прав людини Організації з безпеки і співробітництву в Європі (далі – БДІПЛ ОБСЄ / OSCE/ODIHR) 2023 року, що є фактично і практично новою кодифікацією основоположних засадничих, технологічних, процесуально-процедурних, логістичних, суб'єктно-об'єктних настанов щодо організації, супроводження і забезпечення законотворчого процесу в умовах існування і функціонування демократичної правової держави та її належних інституцій.

Особливої важливості, актуальності та праксеологічної достовірності такій роботі надає низка фактів стратегічної властивості та професійного ґатунку:

- по-перше, відповідно до факту загального сприяння та колективної підтримки – бо Керівні принципи також були рецензовані Європейською комісією з питань демократії права (Венеційська комісія) Ради Європи (міжнародна організація 46 держав-членів у європейському просторі) [3], а також Організацією економічного співробітництва та розвитку (ОЕСР) (міжнародна організація, що об'єднує 34 країни світу, 70 країн мають статус партнерів ОЕСР, беручи участь у багатьох сферах її діяльності) [4] та Парламентською Асамблеєю ОБСЄ (міжпарламентська організація, що об'єднує 57 держав Європи, Азії та Північної Америки) [5] – кожна з наведених організацій має свою автономну правову систему, що хоча й спирається на відповідні статутні або установчі документи колективно-індивідуальної властивості, але передбачає заходи взаємодії з іншими наведеними правовими системами, включаючи й право Європейського Союзу в межах т. зв. «європейського права» та кумулятивний вплив на національні законодавства держав-членів цих міжнародних організацій, – що об'єктивує та актуалізує проблематику уніфікації в спеціалізованому (в межах міжнародних організацій) та національному законотворчому процесі;

- по-друге, відповідно до факту колективної роботи з підготовки профільного документу, бо у розробці Керівних принципів прийняли участь низка знаних фахівців в сфері національного і глобального конституціоналізму, теорії права і держави, теорії, техніки та технології законотворчості і прав людини тощо, а саме: Еліс Томас, International Human, експерт із прав і права; доктор Марта Ахлер, Центр судової співпраці, Європейський університетський інститут; Лоліта Сігане, експерт з питань демократичного врядування та колишній депутат; доктор Ронан Кормакейн, старший науковий співробітник, співробітник Центру верховенства права Бінгема; Ів Дутріо, член Державної Ради Франції; доктор Тімеа Дріноці, запрошений професор, юридичний факультет, Федеральний університет Мінас-Жерайс, Бразилія; Ів Гунен, член Державної Ради Франції; Івар Хендла, стратегічний радник урядового офісу Естонії; Мюррей Хант, директор Центру верховенства права Бінгема, Британського інституту міжнародних і порівняльних досліджень; Лузіус Мадер, колишній заступник директора Федерального управління юстиції Швейцарії та доцент Лозаннського університету Швейцарії; Кріс Молл, старший експерт з верховенства права; Марія Мусмуті, асоційований науковий співробітник Інституту перспективних правових досліджень Лондонського університету та виконавчий директор Центру європейського конституційного права; професор Алан Пейдж, почесний професор публічного права, Університет Данді; професор Кірстен Робертс Лаєр, доцент кафедри публічної політики Центрально-європейського університету; професор, доктор Мелані Енн Саллі,

директор Інституту Go-Governance у Відні; і Франклін Де Вріз, керівник практики підзвітності, Вестмінстерський фонд за демократію [2, p. 6];

- по-третє, відповідно до факту структурно-змістовного наповнення наведеного видання. Воно включає не тільки етапно-стадійну характеристику процесу законотворення, а й визначення його основних термінів (дефініцій), перелік його керівних принципів, визначення кола основних та незалежних осіб, що напряму залучені до законотворчого процесу або можуть приймати участь у його реалізації, перелік основних елементів законотворчого процесу. Також важливу роль відіграють додатки до профільного видання, а саме: I. Вибрані міжнародні та регіональні документи та довідкові документи; II. Глосарій ключових термінів для профільних цілей.

Обґрунтовуючи особливу та актуальну роль феноменології законотворення в Європі, директор БДІПЛ ОБСЄ Маттео Мекаччі, у вступі до видання виокремив низку його настанов, що мають не тільки суто методологічний, а й важливий дидактико-функціональний та поведінково-діяльнісний характер відносно належних та уповноважених суб'єктів держави (органи публічної влади, допоміжні органи, інституції громадянського суспільства тощо), що приймають безпосередню або опосередковану участь у процесі законотворення характер. Отже особлива увага була акцентована на наступному:

А) закони мають величезний, хоча часто й непередбачений, вплив на наше повсякденне життя, формування наших суспільств, наших прав, наших обов'язків та особистих свобод. Отже, якість законів, які впливають на наше життя, є прямим наслідком того, як вони розроблялися та як був досягнутий соціальний компроміс щодо їх прийняття на основі консультування з зацікавленими особами і структурами (настанова про органічний зв'язок між якістю законів та їх впливу на суспільні відносини – авт.);

Б) разом з тим, процес, який призвів до прийняття законів часто здається далеким, недоступним, складним або монополізованим політиками чи технократами (настанова про складну і суперечливу характеристику законотворчого процесу через його організаційну та типологічну складність, недоступність для пересічених громадян та специфічний суб'єктний склад – авт.);

В) своєю чергою, «демократичний відкат», що спостерігається в багатьох місцях навколо ОБСЄ в останні роки, у поєднанні з хвильовим ефектом, який спостерігається в інституціях по всій ОБСЄ, викликаний різними кризами та конфліктами, виявив низку основних недоліків у законодавчих процесах, починаючи: а) з розробки законів, через частий дисбаланс між різними гілками влади, до б) частого використання прискорених процедур та в) відсутності публічних консультацій, – призводять до недовіри суспільства до прийнятого законодавства та демократичних інститутів (настанова щодо прямого зв'язку та суперечностей між демократичною складовою законотворчих (законодавчих) процесів та їх організацією відносно активної участі громадськості в зазначених процесах – авт.);

Г) держави-учасниці ОБСЄ взяли на себе зобов'язання поважати демократичні принципи і верховенство права як критичні елементи для тривалого миру та стабільності в регіоні, і ці зобов'язання також повинні бути відображені в їх законотворчій діяльності (настанова про особливу важливість дотримання державами-членами ОБСЄ демократичних принципів і принципу верховенства права для забезпечення стану миру та стабільності в регіоні – авт.);

Г') хороша законотворчість є наріжним каменем функціонування демократії захисту та реалізації прав людини та, зрештою, сприяє посиленню громадської довіри до демократичних інститутів і процесів (настанова про прямий зв'язок та взаємозалежність феноменології законотворчості з демократичними формами захисту прав людини, та у підсумку, з посиленням громадської довіри до демократичних інститутів і процесів – авт.);

Д) законотворчі процедури та практики повинні відповідати демократичним принципам, дотримуватись верховенства права та відповідати міжнародним зобов'язанням і стандартам у сфері прав людини, відносно яких держави-учасниці ОБСЄ взяли на себе зобов'язання (настанова про прямий зв'язок між законотворчими процедурами та практиками і дотриманням верховенства права та міжнародних зобов'язань і стандартів у сфері прав людини, що узяли на себе держави-члени ОБСЄ – авт.);

Е) майже двадцять років тому БДІПЛ ОБСЄ розпочало оцінку законотворчих систем і процесів для визначення вихідних точок для вдосконалення елементів законодавчих процесів, зрештою прийняття кращого законодавства (настанова про прямий зв'язок між якістю

законотворчих систем і процесів, їх вдосконаленням та прийняттям вдосконаленого законодавства – авт.);

Є) ці Керівні принципи демократичної законотворчості для кращих законів спираються на роботу БДІПЛ і прагнуть надати конкретні практичні рекомендації щодо того, як розробляти якісні закони шляхом підвищення якості законотворчих процесів (настанова про прямий зв'язок Керівних принципів демократичної законотворчості з практикою БДІПЛ в контексті підвищення якості законотворчих процесів – авт.);

Ж) рекомендації пропонують повний набір інструментів для політиків і законодавців щодо того, як зробити і вдосконалити свій законодавчий процес для вирішення сучасних проблем законотворчості напряму та сприяти більшій відкритості, прозорості, підзвітності, інклюзивності та участі на всіх етапах законодавчого циклу (настанова про прямий зв'язок рекомендацій для суб'єктів законотворчого процесу з вирішенням сучасних проблем законотворчості в контекстуалізації залучення до неї широких мас громадськості на всіх етапах законодавчого циклу – авт.);

З) рекомендації є ефективним інструментом забезпечення законотворчих процесів і прийнятого законодавства, що відповідають правам людини, доступні, недискримінаційні, гендерно чутливі і чутливі до потреб різноманітних соціальних груп (настанова про характеристику рекомендацій щодо їх можливості забезпечення інтересів потреб різних соціальних груп – авт.);

И) Керівні принципи також підкреслюють фундаментальну роль, яку відіграють неурядові організації у законотворчому процесі і можуть слугувати інструментом адвокації для громадянського суспільства, забезпечивши, щоб люди, яких стосується законодавство, були поінформовані про це та мали право висловитися у формуванні його змісту (настанова про особливу – фундаментальну роль неурядових організацій у законотворчому процесі – авт.);

І) БДІПЛ сподіваємся, що ці Керівні принципи стануть корисним джерелом інформації та будуть корисними для надання користувачам практичних порад щодо того, як реформувати своє законодавство, правила та практики відповідно до міжнародних прав людини та верховенства права, стандартів і зобов'язань ОБСЄ, що веде до кращої якості законів. Їх остаточна мета полягає в тому, щоб надати особам, які приймають рішення, можливість розробляти законодавство, яке справді служить людям (настанова-телеологічна домінанта про роль та мету Керівних принципів, що скеровані на розробку якісних законів для людей – авт.).

Основні параметрально-технологічні вимоги до європейського законотворення в контекстуалізації підвищення його якості

У Вступі авторський колектив зазначає відповідні параметрально-технологічні вимоги, деякі з яких зазначав директор БДІПЛ ОБСЄ Маттео Мекаччі, але вже інтерпретуючи їх у більш розширеному вигляді та з дидактико-методологічним тлумаченням. Отже:

1. Для цілей цих Рекомендацій термін «закони» використовується авторами в широкому розумінні для позначення юридично обов'язкового документа, прийнятого компетентним законодавчим або виконавчим органом, який кодифікує норми поведінки та містить права, а також обов'язки для окремих осіб, держави та/або інших органів чи організацій. Якщо не вказано інше, сфера дії цих Керівних принципів охоплює, в принципі, первинне законодавство (тобто юридичні тексти, схвалені парламентом або конгресом) і вторинне законодавство (або «підзаконні акти» або «постанови», тобто нормативні акти, прийняті виконавчою владою, з метою реалізації первинного законодавства), оскільки більшість викладених принципів і рекомендацій мають відношення до обох типів законодавства, водночас визнаючи різноманіття практики в регіоні ОБСЄ (дидактично-тлумачний аспект основоположної профільної проблематики – авт.).

2. Позначаючи, що закони мають величезний вплив на повсякденне життя, на права кожного і засоби до існування, констатується, що:

А) якість цих законів нерозривно пов'язана з процесом, який призвів до їх прийняття;

Б) країни-учасниці ОБСЄ взяли на себе зобов'язання поважати демократичні принципи та верховенство права як найважливіші елементи тривалого миру та стабільності в регіоні, і ці зобов'язання також повинні бути відображені в їх законотворчих процесах;

В) враховуючи триваючу ерозію демократичних і конституційних стандартів і правління через використання закону в усьому світі та зниження суспільної довіри до демократичних

інститутів, важливо зміцнювати демократичні інститути та процеси шляхом сприяння відкритості, прозорості, інклюзивності та підзвітності у законотворчій діяльності;

Г) сучасна законотворча діяльність демонструє низку слабких сторін, включаючи відсутність належних обговорень політики, оцінки впливу чи громадських консультацій перед розробкою закону та практики відсунення демократичних інституцій протягом законодавчого процесу (загалом – дидактично-процесуальний аспект профільної проблематики – авт.).

3. У принципі, демократичний законотворчий процес:

А) веде не лише до покращення законів, але зазвичай покращує імплементацію (практичне втіленння) положень прийнятих законів, зрештою підвищуючи довіру суспільства до демократичних інститутів і процесів; ба більше,

Б) повинен забезпечувати, щоб закони були якісними, якщо вони послідовні, чіткі та зрозумілі, передбачувані, прозорі, доступні, відповідні правам людини, ефективні, недискримінаційні, гендерно чутливі та чутливі до потреб різних груп у суспільстві як з точки зору формулювання, так і на практиці після реалізації;

В) отже, процедури та практика правотворчості повинні відповідати демократичним принципам, дотримуватись верховенства права та міжнародних зобов'язань у сфері прав людини і стандартів, – водночас вони мають бути доказовими, відкритими і прозорими, за участю у їх створенні та інклюзивні, а також підлягають ефективному нагляду;

Г) метою Керівних принципів є забезпечення подальшого огляду керівних принципів демократичної законотворчості, а також конкретними та практичними рекомендаціями щодо того, як це керівництво принципів можна дотримуватися на кожному етапі законодавчого циклу для досягнення якісних законів, заснованих на верховенстві права та правах людини;

Г') ці принципи та стандарти лежать в основі процесу підготовки, обговорення, прийняття, імплементації та оцінки законів; в той самий час, коли Рекомендації прагнуть продемонструвати, як зробити такі процеси ефективними;

Д) з огляду на досвід і передову практику з регіоні усієї ОБСЄ, мета Рекомендацій також полягає у з'ясуванні деяких параметрів демократичної законотворчості з використанням зобов'язань ОБСЄ щодо людського виміру та міжнародних стандартів і рекомендацій у сфері прав людини та верховенства права як орієнтирів;

Е) Керівні принципи також відображають важливість дотримання законотворчих принципів і стандартів у часи кризи, спираючись як на досвід пандемії COVID-19, так і на вплив інших надзвичайних ситуацій – вони спрямовані на те, щоб увімкнути об'єктивну, ретельну, прозору та однакову оцінку процесів законотворчості;

Є) Рекомендації ґрунтуються на роботі, проведеній БДІПЛ з оцінки законодавства та законодавчих процесів окремих держав-учасників ОБСЄ за останні 20 років і рекомендації, зроблені саме в цьому контексті;

Ж) такі рекомендації стосуються не лише змісту законів, а також процесу розробки цих законів і консультацій;

З) на основі спостереження, що якість законів є прямим наслідком способу, в який вони були розроблені та консультовані, основна мета Керівних принципів полягає в тому, щоб надати конкретні та практичні рекомендації щодо того, як розробляти якісні закони шляхом підвищення якості законотворчих процесів, вважаючи, що це призведе до більш значущих і стійких реформ;

И) Керівні принципи, своєю чергою, прагнуть забезпечити інструмент для вищезгаданих законодавчих оцінок БДІПЛ для полегшення аналізу конституційної та правової структури даної країни, законодавства та практики з правотворчості;

І) цільовою аудиторією для Рекомендацій є всі, хто бере участь у законотворчій діяльності на державному, регіональному чи місцевому рівнях. До них відноситься уряд, посадові особи та особи, які приймають рішення, парламентарі та парламентські працівники, тобто працівники різних допоміжних органів, що створюються законодавчим органом або виконавчою владою щодо розробки політики і законодавства; експерти, що залучені або уповноважені вдосконалювати законодавство. Вони також адресовані ширшій аудиторії, такій як незалежні інституції, зокрема національні правозахисні інституції (НІПЛ), а також організації громадянського суспільства (ОГС), наукові кола, правозахисники та всі інші люди та організації, залучені до законодавчого процесу у різних якостях;

Ї) визнаючи, що ключові елементи та етапи розробки політики та законодавчої діяльності в більшості держав-учасниць ОБСЄ дотримуються схожих моделей, Керівні принципи та

рекомендації, які вони містять, мають за мету поширюватися на всі демократичні держави, незалежно від того, чи є вони президентськими чи парламентськими демократіями, чи є їхні парламенти однопалатними чи двопалатними. Водночас Керівні принципи визнають різноманіття місцевих традицій, історичних, політичних, соціальних, судових чи географічних контекстів конкретних країн, а також різні правові системи та механізми;

Й) сфера застосування Керівних принципів – Керівні принципи відображають вищезазначені цілі зосередження на повному циклі розробки політики та законотворчості, що лежить в основі всього процесу розробки, складання, консультування та обговорення, перевірки, внесення змін, прийняття, публікації, виконання, моніторингу та оцінки законів. Вони дивляться на стандартні законотворчі процедури. Особливі правила щодо референдумів та подібних форм законодавчої діяльності виходять за рамки цих Керівних принципів, хоча деякі принципи також є актуальними. Хоча деякі з рекомендацій, що містяться в Керівних принципах, стосуються ситуацій воєнного стану/збройних конфліктів, ці питання можуть потребувати окремої оцінки (загалом – дидактично-характерологічний аспект профільної проблематики – авт.).

4. Зміст Рекомендацій у їх структурній побудові включає: Вступ, Частину I з визначенням демократичної правотворчості та якісних законів, опис поняття законодавчого процесу як циклу, Частину II, що містить набір Керівних принципів демократичної законотворчості та як досягти якісних законів, заснованих на принципі верховенства права та стандартів прав людини. Ці принципи складають основу Керівних принципів щодо демократичної законотворчості для кращих законів: вони керують тим, які є закони та як їх створюють (процес створення законів), який стандартизує суть того, що закон повинен дотримуватися (зміст закону) і яку форму має приймати закон (форму законодавства). Частина III представляє ключових учасників законотворчого процесу та їхні ролі. Нарешті, Частина IV містить детальні, конкретні та практичні рекомендації щодо того, як Керівні принципи можуть дотримуватись на кожному етапі законодавчого циклу, щоб сприяти створенню якісно кращого законодавства. Додатки до Методичних рекомендацій містять посилання до окремих міжнародних і регіональних інструментів, документів і справ щодо права, а також глосарій з основними термінами (дидактично-структурологічний аспект профільної проблематики – авт.).

Важливу роль, особливо для дослідження, що проводиться мають структурно-номенологічні характеристики наведених Рекомендацій, зокрема, Частини III, яка поіменована «Головні актори, що беруть участь у законотворчому процесі». Праксеологічна цінність цієї частини міститься не тільки в найменуванні відповідних акторів-учасників законотворчого процесу, а й у вибудовуванні відповідної логістичної системи, в якій кожний з таких акторів має свої права, повноваження або можливості брати участь у профільному процесі, впливаючи позитивно на підвищення його оптимальності, ефективності та якості.

Настанови діяльності допоміжних структур органів публічної влади в законотворчому процесі

Законотворчий процес – під час якого політики та закони готуються, обговорюються, перевіряються, переглядаються, зрештою приймаються та оприлюднюються, контролюються та оцінюються, – відрізняється в кожній країні, але різні його учасники і їхні ролі є часто дуже схожими. Саме тому Керівні принципи демократичної законотворчості описують цих головних акторів, їхні завдання, що вони повинні включати в порядку свого сприяння, відповідно до своїх мандатів, демократичному законотворчому процесу, який відповідає ключовим принципам, викладеним в Частині II Керівних принципів.

Треба зазначити, що крім основних органів публічної влади (законодавчої, виконавчої, судової) в законотворчому процесі приймають активну участь допоміжні органи, які формуються при цих органів та надають їм допомогу в профільній діяльності.

Провідне місце в системі допоміжних органів при вищих органах державної влади посідають Апарат Верховної Ради України, Адміністрація Президента України та Секретаріат Кабінету Міністрів України. Від професійності їхніх дій часто залежить ефективність рішень та інших актів, що ухвалюються вищими органами державної влади. Між тим конституційно-правовий статус допоміжних органів та правовий статус їхніх працівників на законодавчому рівні визначений не чітко, у зв'язку з чим суттєво знижується ефективність діяльності цих органів і, як наслідок, вищих органів державної влади, при яких вони утворюються. Отже, удосконалення конституційно-правового регулювання діяльності допоміжних органів при вищих органах

державної влади, оптимізація їх системи та структури, визначення способів конституювання допоміжних органів є важливими завданнями сучасної конституційно-правової науки [6, с. 1].

На практиці парламенти можуть створювати робочі групи для розробки законів, залучаючи не лише парламентарів, а й експертів та представників громадянського суспільства, зокрема. При створенні таких робочих груп важливо забезпечити, щоб вимоги до експертів та представників громадянського суспільства є прозорими, водночас забезпечуючи інклюзивність складу робочої групи і гендерно збалансованими [7].

Крім того, треба враховувати, що достатні ресурси та належний допоміжний персонал, включаючи розробників законів або інші форми підтримки, необхідні для належного функціонування парламентів, для виконання ними законодавчих, представницьких і наглядових функцій. Бо добре підготовлені, аполітичні та компетентні парламентські кадри забезпечують ноу-хау та дослідження, необхідні для якісних законопроектів і парламентські зміни до законів для депутатів як правлячих, так і опозиційних партій. Якщо цього не вистачає, якість законодавчої підготовки, а також професійне спілкування між різними законодавцями (наприклад, подання народними депутатами законопроектів, аналогічних ініційованим урядом), можуть бути непослідовними, що негативно вплине на загальний законотворчий процес. Тому адекватне та безперервне навчання щодо використання посібників із складання проектів, застосування законодавчих методів та інших вказівок є фактично стратегічно важливим. І тому слід також надати не тільки персоналу, який підтримує депутатів у розробці законодавства, можливість ініціативи на внесення пропозицій відносно поправок, а також й державним службовцям, які готують та опрацьовують законопроєкти.

Прикладом тут може слугувати Парламент Ірландії при якому створений Офіс парламентських юридичних радників (OPLA) [2, p. 28], що є внутрішньою юридичною командою палат Oireachtas (парламент Ірландії), який повністю незалежний від уряду, і який надає спеціалізовані неупереджені юридичні консультації з широкого спектру питань – парламентських, конституційних, корпоративних та інших правових питань для Парламенту, його членів і персоналу. Це включає юридичні консультації та підтримку юридичних питань, що виникають у комітетах Oireachtas, вивчення та оскарження питань політики, що підтримується урядом, і його законопроектів, а також надання консультацій з правової політики та послуг з розробки проєктів законодавчих актів для неурядових членів Oireachtas (включаючи початкове дослідження, розробку стратегічної пропозиції, складання проєкту закону і поправок до нього, а також надання допомоги у попередньому розгляді проєкту на стадії розгляду в комітеті парламенту).

Керівні принципи містять в собі відповідні положення, що при відповідній і профільній інтерпретації можуть надати відповідь на питання: як допоміжні органи парламентів можуть сприяти демократичному законотворчому процесу та кращій якості законів. Для цього треба розглядати відповідні повноваження та можливості самих парламентів, але інтерпретуючи їх у організаційному аспекті, технологічному контексті та більш лапідарному розумінні.

Отже, допоміжні органи парламентів повинні організовувати, супроводжувати та забезпечувати відповідну діяльність парламентських структур щодо:

- належного, своєчасного та раннього законодавчого планування, скоординованого з іншими суб'єктами законотворчого процесу, наприклад, уряду;

- підготувати відповідні положення парламентських регламентів, щодо того, що законопроєкти, підготовлені народними депутатами, повинні:

А) наскільки це можливо, слідувати аналогічним процесам перевірки якості, а також оцінки регуляторного впливу (ОРВ), підготовці пояснювальних записок і процедури консультацій, включаючи й урядові законопроєкти, щоб забезпечити такі проєкти законів подібної і належної якості, в той час як буде належне забезпечення і належна підтримка, включаючи й ресурси для цієї мети;

Б) зокрема, і в тому випадку, навіть якщо цього не вимагає закон, треба організаційно забезпечити прийняття парламентських законопроєктів, а проєкти поправок підлягають ОРВ, особливо якщо вони мають суттєве значення та вплив на фундаментальні права особи чи довкілля, чи на державний бюджет;

В) у випадках, коли певні типи законопроєктів мають проходити ОРВ відповідно до закону на передпарламентській стадії, цей обов'язок має бути поширений і на парламентську фазу, більш того, він повинен супроводжуватися пакетом документів, що: а) надають інформацію про необхідність закону, б) про його відповідність міжнародному та національному законодавству

та в) про відповідну ОРВ, включаючи економічні, екологічні, соціальні відносини, вплив статі та інших ознак;

Г) організувати, крім конституційної роботи, діяльність бюджетного, фінансового парламентських комітетів, окремий профільного парламентського комітету (ів) або іншого парламентського органу чи структури, що відповідає за оцінку прав людини та гендерні відповідності запропонованих законопроєктів із чітким мандатом, а також фінансовими та людськими ресурсами для цього.

- провести організаційну роботу щодо виділення належного часу між сесіями та голосуванням, щоб забезпечити змістовний парламентський аналіз, дебати та загальний нагляд в профільному законотворчому процесі;

- організувати інклюзивні та змістовні громадські слухання та/або громадські консультації, з належним механізмом зворотного зв'язку, навіть якщо це не передбачено законом, особливо коли запропонований закон може мати вплив на функціонування державних установ, включно з судовою системою та правами людини;

-через організацію відповідного навчання розвивати спроможність працівників парламенту підтримувати роботу парламентарів, а також розвивати навички законодавчої та законотворчої діяльності та надавати вказівки в процесі законотворення, зокрема щодо дотримання прав людини, охоплюючи також недискримінаційне законодавство, яке враховує гендерні аспекти та різноманітність;

- забезпечити відкритість і прозорість парламентської роботи та сесій, публічних дебатів/слухань, у тому числі через наявність доступного, зручного та зрозумілого веб-сайту (але також офлайн-ресурсів), що у підсумку має дозволити громадськості легко отримати доступ до законопроєктів і пов'язаної з ними документації (наприклад, відповідної ОРВ, передумов розробки і прийняття, а також обґрунтування законопроєкту), а також надати огляд і аналіз результатів консультацій і пояснень до законопроєкту, визначаючи сумісність з конституцією та іншими законами та з міжнародно-правовими зобов'язання держави щодо прав людини.

-здійснювати моніторинг та оцінку прийнятого законодавства, включаючи, якщо це доцільно, збір даних, дезагрегованих за статтями та іншими відповідними характеристиками законодавчого акту.

Велика роль допоміжних органів спостерігається й у діяльності урядів, що приймають активну участь у законотворчому процесі.

Керівні принципи містять відповідні положення, де визначають, що способи розробки політики та законів у регіоні ОБСЄ обговорюється всередині уряду, але вони різняться між державами, враховуючи різні типи урядів, їхні внутрішні робочі процеси та різні рівні відкритості та прозорості, що відзначають їхню роботу.

Отже, уряди можуть бути ініціаторами законопроектів, які потім обговорюються, змінюються та приймаються парламентами. За певних обставин вони також можуть підготуватися та прийняти відповідні декрети, якщо їм надано це повноваження конституцією або делегуванням цих профільних парламентських повноважень. Уряди та окремі міністерства чи агенції зазвичай також відповідають за прийняття підзаконних актів в контексті виконання законів.

Як і інші органи державної влади, виконавча влада несе відповідальність за захист, повагу та дотримання прав людини під час виконання своєї ролі у процесі законотворчості. Це вимагає позитивних дій у законодавстві та політиці, щоб гарантувати людям можливість користуватися своїми правами та здійснювати їх вільно. Це також означає пам'ятати про гендерні зобов'язання та різноманітність, що нав'язані державам міжнародними угодами і активно заохочують ці та інші права. Він також вимагає від держави забезпечення захист осіб від порушень своїх прав і мати доступні ефективні засоби правового захисту там, де їхні права порушено. Разом з тим, саме з цих настанов випливає особлива та важлива роль допоміжних органів у супроводженні та забезпеченні виконання наведених завдань.

Отже, саме допоміжні органи (апарат та його структури) Уряду повинні організовувати, супроводжувати і забезпечувати належне завчасне урядове планування політики та законодавства, виділяючи достатньо часу для кожного етапу політики та законодавчих циклів різних законодавчих проєктів певного міністерства чи іншого державного органу [8, с. 31]. Слід також враховувати темпоральну протяжність та/або складність законодавчих ініціатив або їх широкість у контекстуалізації реформ, які можуть суттєво вплинути на значні частини

населення [9, п. 13 та абз. 35-39.]. Це також включає достатньо часу для організації допоміжними органами початкових обговорень щодо формування політики, процесів перевірки, оцінки впливу та публічних консультацій.

Допоміжні органи Уряду повинні організувати від його імені завчасне інформування парламенту про політичні заходи та законодавчі пропозиції, які будуть подані протягом найближчих місяців і років. Важливо також забезпечити належну співпрацю між урядом та парламентом протягом реалізації усієї політики та процесів законотворчості. Це має включати регулярний обмін оновленнями політики та законодавчих планів, узгодження відповідних законодавчих планів і стратегій, розширення офіційних механізмів координації між ними.

Процес планування також має узгоджуватися з державним бюджетним циклом і відображати бюджетні асигнування та видатки.

Більшість урядів мають певні правила процедури, які окреслюють їхні повсякденні робочі процеси, що організують допоміжні органи, в тому числі у сферах політики та законотворчості. Зазвичай вони окреслюють різні кроки, які необхідно виконати в контексті розробки політики або законів. Зазвичай вони включають різні етапи співпраці та консультацій між ініціюючим органом (наприклад, міністерство чи інше державне відомство чи агентство) та зацікавленими сторонами в уряді та за його межами (включаючи міністерства юстиції та фінансів), у тому числі шляхом публічних консультацій, особливо коли вони вимагаються законом. Важливо також передбачити інституційний механізм, за допомогою якого створюються умови для покращення становища жінок і гендерну рівність, що систематично встановлюються у вигляді обов'язкових вимог до процесу розробки політики та законодавства, включно з попередньою та фактичною оцінками впливу (ОРВ), а також із виділенням для цього відповідних ресурсів. Крім того, має бути сформовано наглядовий механізм всередині уряду для проведення перевірок як щодо дотримання відповідних процедур, включаючи ОРВ та процедури консультацій, а також щодо змісту та якості аналізу та висновків, представлених до законопроєкту, перш ніж вони будуть подані до уряду для остаточного затвердження. Останній крок перед чернеткою Закону, що вноситься до парламенту, зазвичай відбувається прийняття проєкту закону на засіданні уряду. Правила процедури можуть бути дуже детальними або в деяких випадках носити досить загальний характер, що на практиці буде надавати більшої свободи дій. Спосіб інформування про внутрішню роботу уряду інших зацікавлених сторін і громадськості, а також те, на яких різних етапах політики та законотворчості оприлюднюються їх результати, також значно відрізняється і залежить від того, як уряди сприймають себе та свою роль по відношенню до громадськості. Основну роль в реалізації наведених організаційних та технологічних настанов належить допоміжним органам уряду.

Важливим досягненням Керівних принципів є розробка відповідних положень відносно можливостей урядів щодо їх сприяння тому, щоб законотворчі процеси були демократичними та призводили до розробки та прийняття якісного законодавства [2, с. 35]. Подібні міркування і рекомендації можуть також стосуватися президентських адміністрацій, коли вони мають право ініціювати закони, залежно від ступеня їхніх повноважень та оскільки вони є окремими органами, а не частиною Уряду.

Вважаємо, що наведені положення можуть бути інтерпретовані на рівень допоміжних органів урядів, які фактично й організують, супроводжують та забезпечують їх діяльність у законотворчому процесі.

Отже, допоміжні органи уряду можуть сприяти демократичному законотворчому процесу та кращій якості законів через реалізацію низки форм організаційної, методичної, технологічної властивості. А саме через:

- забезпечення належного, своєчасного та раннього законодавчого планування, скоординованого з іншими суб'єктами законотворчого процесу, наприклад, парламенту, а також із належним і реалістичним бюджетним плануванням;

- організаційне та технологічне сприяння та домагання щодо створення робочих груп з розробки законопроєкту, склад яких є гендерно збалансованим і репрезентує різні спільноти;

- забезпечення відкритості і прозорості політичних дискусій та інших стадій розробки законодавчих актів;

- проведення поглибленого ОРВ, у тому числі щодо статі, різноманітності, економіки, навколишнього середовища і соціальних аспектів, під час обговорення проєктів політики чи законів, з глибиною і обсягом аналізу пропорційного потенційній значущості проєкту політики чи закону;

- організацію інклюзивних та змістовних публічних консультації з належним зворотним зв'язком та механізмів, що включають зацікавлені сторони, які зацікавлені або можуть бути піддані впливу або будуть відповідати за імплементацію запланованого законодавства та/або їхніх представників на різних етапах розробки проєктів законів чи політики, у тому числі на ранній стадії в робочих групах або редакційних комітетах;

- проведення інформаційно-роз'яснювальної роботи, щоб отримати інформацію від широкого кола зацікавлених сторін (національних, іноземних та міжнародних) та громадськості, досліджуючи нові та інноваційні шляхи для належного залучення останніх до політичних дискусій;

- розвиток навичок та здібностей розробників законодавства в уряді, в тому числі про те, як підготувати проєкти законодавчих актів, що відповідають правам людини (тобто також є недискримінаційними, гендерними та різноманітними), і сформулювати їх у чіткий, передбачуваний і послідовний спосіб;

- створення в уряді механізмів контролю для проведення перевірок щодо відповідності законопроєктів відповідним процедурам, включаючи процедури ОРВ та консультацій, а також щодо змісту та якості аналізу, представлених висновків та самого законопроєкту;

- забезпечення узгодженості документації законопроєктів, поданих на консультації та до парламенту, таким чином, щоб до кожного подання додавався інформаційний пояснювальний меморандум, який інформував суб'єктів, які беруть участь у законотворчому процесі, про необхідність закону, про те, як він відповідає національним та міжнародним (де це є застосовним) правовим системам, його можливому впливу на різні права та інтереси, а також докази, на яких вони ґрунтуються, а також іншу відповідну інформацію;

- організацію моніторингу виконання прийнятого законодавства, включаючи, у відповідних випадках, збір даних з розбивкою за статтями, віком та іншими відповідними характеристиками;

- проведення належної оцінки існуючого законодавства та його впровадження за допомогою різних зацікавлених сторін, включаючи особливо зацікавлені групи або тих, хто найбільше постраждав від законів, а також визначити можливі прогалини та наступні визначення законодавчих чи незаконодавчих рішень.

Вважаємо, що наведені настанови є фактично першою спробою кодифікації в межах ОБСЄ ролі і значення допоміжних органів законодавчої та виконавчої влади в законотворчому процесі, що буде сприяти їх активному запозиченню та використанню державами-членами цієї та інших міжнародних європейських організацій інтеграційного ґатунку.

В Україні, крім структур апарату Уряду, передбачена можливість створення консультативно-дорадчих органів як суб'єктів формування та реалізації різних напрямів політики, що є також допоміжними органами виконавчої влади. Правовою основою утворення та діяльності таких органів є Конституція України, закони та інші нормативно-правові акти. Статус консультативно-дорадчого органу, повноваження, основні напрями і форми діяльності визначаються положенням про конкретний орган чи спеціальним актом відповідного державного органу – постановою, розпорядженням, наказом тощо. Порядок створення консультативно-дорадчих органів визначається Постановою Кабінету Міністрів України «Питання консультативних, дорадчих та інших допоміжних органів, утворених Кабінетом Міністрів України» від 17 червня 2009 року, № 599 [10]. Надання права на утворення консультативно-дорадчих органів центральними органами виконавчої влади передбачається відповідним положенням про центральні органи виконавчої влади.

Допоміжний орган утворюється як:

- комісія – для забезпечення узгодження дій центральних і місцевих органів виконавчої влади з питань, пов'язаних з реалізацією повноважень Кабінету Міністрів України;

- комітет – для розгляду питань щодо присудження державних премій;

- організаційний комітет (координаційний центр) – для забезпечення узгодження дій центральних і місцевих органів виконавчої влади, органів місцевого самоврядування, підприємств, установ та організацій з питань підготовки і проведення заходів загальнодержавного значення;

- рада – для вивчення проблемних питань, пов'язаних з реалізацією державної політики у відповідній сфері;

- робоча група – для участі у підготовці проектів нормативно-правових актів, інших документів, що подаються на розгляд Кабінету Міністрів України;

- урядова комісія – для розслідування причин аварії (катастрофи), вжиття заходів до подолання наслідків стихійного лиха, надання допомоги потерпілим громадянам та їх сім'ям;

- міжвідомча робоча група – для забезпечення узгоджених дій центральних та місцевих органів виконавчої влади, вивчення ситуації в окремій сфері, підготовки пропозицій та рекомендацій Кабінету Міністрів України для забезпечення моніторингу під час вирішення фінансово-економічних та інших питань.

У разі недоцільності подальшого функціонування допоміжного органу або виникнення потреби в достроковому припиненні його діяльності Кабінет Міністрів України приймає за пропозицією відповідного органу виконавчої влади або з власної ініціативи рішення про його ліквідацію.

Відповідно до Типового Положення, затвердженого Постановою Кабінету Міністрів України від 17 червня 2009 року, № 599 [11] – допоміжний орган у своїй діяльності керується Конституцією і законами України, а також указами Президента України та постановами Верховної Ради України, прийнятими відповідно до Конституції і законів України, актами Кабінету Міністрів України та цим Положенням.

Основними завданнями допоміжного органу є:

- сприяння забезпеченню координації дій органів виконавчої влади з питань, що належать до його компетенції;

- підготовка пропозицій щодо формування і реалізації державної політики у відповідній сфері;

- визначення шляхів, механізмів та способів вирішення проблемних питань, що виникають під час реалізації державної політики у відповідній сфері;

- підвищення ефективності діяльності центральних і місцевих органів виконавчої влади;

- удосконалення нормативно-правової бази з відповідних питань;

- виконання інших завдань, передбачених актом Кабінету Міністрів України.

Допоміжний орган має право:

- отримувати в установленому порядку від центральних і місцевих органів виконавчої влади, органів місцевого самоврядування, підприємств, установ та організацій інформацію, необхідну для виконання покладених на нього завдань;

- залучати до участі у своїй роботі представників центральних і місцевих органів виконавчої влади, органів місцевого самоврядування, підприємств, установ та організацій (за погодженням з їх керівниками), а також незалежних експертів (за згодою);

- утворювати у разі потреби для виконання покладених на нього завдань постійні або тимчасові робочі групи;

- організовувати проведення конференцій, семінарів, нарад та інших заходів; - мати інші права, що визначені актом Кабінету Міністрів України.

Допоміжний орган під час виконання покладених на нього завдань взаємодіє з державними органами, органами місцевого самоврядування, підприємствами, установами та організаціями.

Системний аналіз та використання компаративно-правового методу дослідження дає змогу стверджувати, що в основному настанови відносно ролі і значення допоміжних органів публічної влади, що зафіксовані в Керівних вказівках /принципах/ щодо демократичної законотворчості для кращих законів, в основному відповідають настановам національного законодавства в профільній сфері.

Висновки

Враховуючи той факт, що законотворення виступає одним з найважливіших інституційно-структурних аспектів існування і функціонування державності, детермінує її існування, функціонування, реалізацію основоположних поведінково-технологічних та діяльнісно-парадигмальних засад та стимулює її розвиток та вдосконалення через регламентацію та правове регулювання профільних процесів, – процеси доктринально-наукового, організаційно-нормативного та технологічного забезпечення законотворчого процесу набувають не тільки об'єктивації і контекстуалізації, а й актуалізуються в умовах посилення міжнародного міждержавного інтеграційного співробітництва.

Треба зазначити, що у його сучасному вигляді таке забезпечення є недостатнім, бо у чинному конституційному законодавстві держав лише частково врегульовано окремі форми профільного забезпечення законодавчого процесу, що робить профільну проблематику актуальною з позицій її доктринального супроводження і нормативного забезпечення.

Звідси суттєво зростає не тільки роль запозичення іноземного досвіду в профільній сфері, а й використання такого досвіду, що в концентрованому вигляді кодифікується в межах

міжнародних міжурядових організацій регіонального – європейського рівня, в нашому випадку ОБСЄ.

Отже, Керівні вказівки /принципи/ щодо демократичної законотворчості для кращих законів, які розроблено в межах ОБСЄ у 2023 році, виступають суттєвим прикладом новітньої кодифікаційно-інтегрованої діяльності у найважливішій сфері існування та функціонування державності, включаючи й проблематику логістичного супроводження і забезпечення законодавчого процесу. Такі принципи торкаються як законопроєктування, так й власне законотворчості, вони мають суттєвий демократичний потенціал, бо скеровані на залучення до законотворчості широкого кола суб'єктів, починаючи від уповноважених органів публічної влади (законодавчої, виконавчої, судової), їх допоміжних органів, і закінчуючи залученням широких верств населення, а також інституцій громадянського суспільства, що уособлюють їх різні інтереси.

Допоміжні органи парламентів та урядів фактично організують, супроводжують та забезпечують їх діяльність у законотворчому процесі. Наведені в Керівних принципах настанови є фактично першою спробою кодифікації в межах ОБСЄ ролі і значення допоміжних органів законодавчої та виконавчої влади в законотворчому процесі, що буде сприяти їх активному запозиченню та використанню державами-членами цієї та інших міжнародних європейських організацій інтеграційного ґатунку.

Порівняльно-правовий аналіз наведених в Керівних принципах настанов відносно ролі допоміжних органів публічної влади в законотворчому процесі та положень щодо правового статусу консультативних, дорадчих та інших допоміжних органів публічної влади в Україні свідчить про загальну відповідність останніх настановам Керівних принципів в профільній сфері.

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Journalism

MODEL OF NATIONAL-CULTURAL REVIVAL: ITS EXPRESSION IN THE MEDIA

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ҰЛТТЫҚ ЖӘНЕ МӘДЕНИ ЖАҢҒЫРУ ҮЛГІСІ: БҰҚАРАЛЫҚ МЕДИАДАҒЫ КӨРІНІСІ

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Abstract

In the new technological era, the preservation of national identity, the development of culture and language is carried out with significant difficulties. This is significantly influenced by the process of globalization. Information and the tools for its dissemination have become an important component in determining the spiritual orientation of the people and the formation of national ideology.

The article examines these processes through media representations of the model of national-cultural revival. The formation of national ideology in modern Kazakh society remains a serious problem. The authors come to the conclusion that such complex issues can be effectively resolved with the help of the media and show its important role in the spiritual revival of the people.

Аннотация

Жаңа технологиялық дәуірде ұлттық болмысты сақтау, оның мәдениеті мен тілін дамыту айтарлықтай қиындықтармен жүргізілуде. Бұған жаһандану процесі де әсер етуде. Халықтың рухани бағдарын анықтауда, ұлттық идеологияны қалыптастыруда ақпарат пен оны таратушы құралдар маңызды күшке айналды.

Мақалада бұл процестер ұлттық және мәдени жаңғыру үлгісінің медиадағы көріністері арқылы қаралады. Қазіргі қазақ қоғамындағы ұлттық идеология қалыптастыру басты проблема болып қалуда. Авторлар бұндай күрделі мәселелерді бұқаралық медиа арқылы жүргізген тиімді деген тұжырым жасайды, медианың рухани жаңғыруда атқаратын маңызды рөлін көрсетеді.

Keywords: *national revival, mass media, national ideology, civilization, new thinking.*
Түйін сөздер: *ұлттық жаңғыру, медиа, ұлттық идеология, өркениет, жаңаша ойлау.*

Кіріспе

Тарих сахнасында белгілі бір орын алып, күн кешкен қай халық үшін де әлдебір рухани тірек, рухани бағыт, биік сенім-наным мен идеология керек. Бұндай рухани тірек болмаған жағдайда халықтың ой-санасы да, ділі мен тілі жойылып, анық дағдарыс немесе күйзеліске ұшырауы мүмкін. Адамзат тарихында ежелден қалыптасқан келген үрдістер халықтың мәдениетінде ұлттық өрнек пен биік мұраттар қатар өріліп, үйлесіп жататынын көрсетеді. Мәдениет саласында бұрыннан келе жатқан ұлттық үйлесімділік, әрбір адамға түсінікті, асыл адамгершілік үлгілері бүгінде өзінің қасиетінен айрылып бара жатқан сияқты.

Шынайы ұлттық мәдениетте әрқашанда жалпыадамзаттық үлкен мән-мағына жатады. Ұлы суреткер қашанда тек өз ұлттының атынан сөйлемейді, барша адамзат баласы болып ой толғайды. Бұған қазақтың ұлы ақыны Абайдың сөз бен ой әлемі дәлел. Ұлы ақын шығармалары таза қазақ топырағында туғанымен, ақын шығармаларында Батыс пен Шығыс тұтаса келіп, ортақ үйлесім тауып тоғысқан. Қазіргі ақпараттық дәуірде әрбір ұлттың мәдениеті өзінің ұлттық сипатын жоғалтпайын десе өзінің барар бағытын, даму жолын ғажап сөз зергері, кемеңгер ақыл-ой иелерінің салған өшпес те өрелі мәдени дәстүрі негізінде түзегені жөн.

Ең бастысы, бұрыннан белгілі бір жайт – өз күші мен қуатына, өзінің бүгіні мен ертеңіне сенгендер ғана болашағы үшін жанқиярлықпен еңбек етіп, ерен де жойқын қимылға бара алмақшы. Сондықтан да, әлемдегі барлық ұлттар сияқты қазақ ұлты үшін, бүгінгі таңда елдің мәдениетін, рухани асыл дүниелерін жаңа бір биіктерге шығармақ ниетке анық бел буған халық үшін ұлттық қазыналарымыз бен қасиеттерімізді барынша құрметтеп, ардақтап, жалпы әлемдік тұғырға көтеруге сенім мен тегеурінді қайрат керек.

Нәтижелер мен талқылаулар

Ұлттың мәдениетін, қазақы рухани дүниесін бүгінгі тығырықтан алып шығып, ырысты да берекесі биік деңгейге көтеріп, алдағы жаңа заманда бүкіл адамзаттық өркениетте өзіне лайықты орын алауы – бүгінгі қазақ халқы үшін әрі сын, әрі міндет. Болашақта көшбасшы, беделді ұлт болып қалыптасуға ұмтылған қоғамда сенімділікті сақтау, ұрпақ тәрбиесі баршаға ортақ болуын қамтамасыз ету шарт.

Өзара келісім, сыйластық жоқ жерде жұрт болашағынан жақсы нәтиже күту бекершілік. Ұлттық рухты қорғау арқылы жақсы тәжірибе жинауға болады. Яғни, өсіп келе жатқан жас ұрпақ қандай негіздерге мән беруі тиіс деген мәселенің шешімін табу қиынға соқпайды. Ұлттың осы уақытқа дейін бойына сіңген қасиеттерінің қайсысын дамыту керек екенін, тозығы жеткен қайсысы деп жан-жақты зерттеген соң тиісті шешімдер қабылдауға болады. Әрбір ұлт үшін бостандық пен тәуелсіздік жолындағы күрес қаншалықты маңызды болса, тәуелсіздікке қол жеткізген соң ұлттық негізін сақтап қалу, ұлттық қасиетті қорғау да соншалықты қымбат. Бостандық пен тәуелсіздік жолындағы күрес ұлттың рухымен, санасымен, сезімімен және тарихи қасиеттерімен байланысты жүзеге асатыны мәлім [1].

Мемлекет пен азаматтардың жалпы рухани міндеттерінің арасынан табылатын идеологияның маңызы қазірде артып отыр. Біздің рухани кеңістігіміз барынша тығыздалып, толтырылған. Егерде ұлттық құндылықтардың тамырын іздер болсақ, онда бұл ізденіс мәдени қарым-қатынастардың дамуымен байланысты болары күмәнсіз. Оған мысалдар да жетерлік. Кеңестік кезеңде ұмытыла бастаған Ұлыстың ұлы күні – Наурыз мейрамын қайта жаңғыртып, жаңаша мазмұнда тойлау, халықтық салт-дәстүрге айналдыру соның бірі. Осының нәтижесінде Қазақстандай көпэтносты мемлекет жағдайында Наурыз арқылы халқымыздың тамаша салт-дәстүрлерін, үйлесімді әдет-ғұрыптарын насихаттауға мүмкіндік алдық.

Бұл жерде көп мәселе Қазақстан халқының негізін құрайтын қазақ ұлтының рухани әлемінің жоғарылығына, рухани қуаты мен тегеурініне байланысты екендігін көреміз. Бүкіл Қазақстан халқын бір мақсатқа жұмылдыру қажет болған жауапты тарихи кезеңде қазақ менталитетінің жаңа ортаға бейімделе алуының маңызы зор.

Қазақ халқының рухани мәдениеті – ұлттың тарих сахнасында қалыптасқан мәдени мұрасы мен білімі, сенімі мен әдет-ғұрып, салт-дәстүрі. Бүгінгі таңдағы ғылыми түсінік ғылым мен білімді, әдебиет пен өнерді, азаматтардың білім өрісі мен сауатын, халықтың тұрмыс-тіршілігі мен өндіріс ауқымын мәдениеттің аясына сыйғызады. Демек, мәдениет дегеніміз – адамзат баласының ақыл-ойы мен қажыр-қайраты тудырған жетістіктердің бәрін қамтиды деген тұжырым жасауға толық негіз бар [2].

Кез-келген ұлттық мәдениетте салт-дәстүрлер жүйесі ерекше рөл атқарады. Бұл туралы белгілі философ Гердер: «Салт-дәстүр – тіл мен мәдениет бастауларының анасы» деген салмақты пікір айтса, ғалым-зерттеуші Ғ.Ақпанбет: «Мәдениет өзінің кең мағынасында бір

ұрпақтың келесі ұрпаққа жолдаған өмір сүру тәсілі болғандықтан, осы жалғастықты, мұрагерлікті жүзеге асыратын салт-дәстүрлер жүйесі – рухани мәдениет өзегін құрастырады» деген екен. Әсіресе, жазу-сызуы болмаған халық ерте заманда мәдени ырымдар мен сәуегейлікке, сенім-нанымдарға, дәстүрлі түсініктерге иек артқан. Олар терең философиялық ойдың, ғасырлар бойы жинақталған тәжірибенің сұрыпталған тұжырымы, көркем бейнесі. Бірақ мәдениет деген терминнің тек Батыс Еуропада ғана 250-ден астам анықтамасы бар екендігін естен шығармауымыз керек. Бұл оның жергіліктi, аймақтық, ұлттық және халықаралық аядағы мәні мен болмысы туралы пікірлердің әртүрлі болатындығын білдіреді [3].

Бұның сыртында көркемөнер мәдениеті, экономикалық мәдениет, экологиялық мәдениет, ғылым мәдениеті, әлеуметтік мәдениет, оқу мәдениеті, бұқаралық ақпарат құралдарының мәдениеті, тағы басқалар деп мәдениетті біртұтас әлеуметтік-экономикалық қоғам аясында жіліктеп қарауды ұсынатындар да бар. Тарихи қалыптасқан сондай ерекшеліктердің негізгілеріне тоқтала кетейік.

Біріншіден, қазақтардың көшпелі сипаты, ұдайы мал бағып, оның соңында көшіп-қонып жүруі. Ол үшін көбінесе ен дала, жазық жайлаулардың, тіпті шөлді жерлердің қажеттілігі де бар еді. Екіншіден, көшпелі халықтың бүкіл өмір сүру тәсілі, әдет-ғұрпының сол көшпелі тұрмысқа бейімделуі, көшпелі елдің бүкіл тұрмысы өмір сүрген ортаға сәйкестендірілген. Үшіншіден, көшпелілердің бір жерге шоғырланбай мал бағу жағдайына сәйкес ауыл-ауыл болып, бірінен-бірі алшақ тұруы. Осыдан келіп, отырықшы ел уәкілі, айталық, қала тұрғыны, далалы жерге барып, өзімен-өзі болуды аңсайтын болса, көшпелі ел адамдары басқа адамдармен кездесуді, сөйлесуді аңсайды. Сол аңсау мен армандау сарынын кешегі, бүгінгі өмірден бағамдап-байқап, талғампаздықпен танып, білеміз.

Біздің мемлекетіміздің іргетасы – қазақтың ұлттық санасы. Мемлекеттің құрылуына, оның нығаюына бірден-бір мүдделі ұлт – қазақ. Бұл шындықты байқамау тарихқа қиянат жасаумен бірдей. Қазіргі таңда мемлекетіміздің жалпыұлттық идеологиясының өзі бірін-бірі толықтырып тұрған екі тармақтан тұрады. Біріншісі – қазақ халқының басын біріктіруге, санасын оятып, оның рухани түлеуіне бағыттайтын жаңғыру идеологиясы, яғни ұлтты ұйыстыру немесе ұлт ішіндегі бірлікті нығайту. Екіншісі – Қазақстанда мекендеген ұлт пен ұлыстардың өкілдерін біріктіретін, яғни ұлтаралық жарасым идеологиясы немесе «Қазақстан – менің Отаным» идеясы.

Ұлттық саясаттағы осы қос тармақты бір-бірімен жалғап тұратын алтын көпір – қазақ ұлтының қазіргі тарихи біріктіруші рөлі. Осы «алтын көпір» арқылы барлық халықтардың, ұлттар мен ұлыстардың теңдігін қамтамасыз етуді ешқашан естен шығаруға болмайды. Мұның өзі «Қазақстан – менің Отаным» деп танитын барлық этнос өкілдеріне қазақ ұлты беретін тарихи кепілдемесі деп қарау қажет.

Туған халқының түпкі арманына жету үшін әр кезеңге сай нақты бағдарламасы, мақсат – мұраты болмай ешқандай қоғам пәтуалы болмақ емес. Сол үшін де әрбір қоғам өзінің мемлекеттік саясаты мен идеологиясын айқындайды. Демек, идеология дегеніміз – белгілі бір мақсатқа жетудің жолы, соның рухани негіздеушісі және тиянақтаушысы, тұғырнамасы. Оларды жекелеп айтсақ — тәуелсіздік идеясы, нарық идеясы, ұлттық қазақ идеясы, тәрбие идеясы, топтастыру идеясы, келісім идеясы, қорғаныс идеясы және тағы басқалар. Заманауи қоғамдар идеологиялық жүйесіз өмір сүре алмайды. Идеология – бұл адамдардың қоғамдастығын, саяси және экономикалық міндеттерді шешуге топтастыру мен жұмылдыру тәсілі және әлеуметтік мінез-құлықты қалыптастыру механизміне айналды [4].

Ұлт санасын оятып, «қазақ идеясын» дүниежүзілік қауымдастыққа енгізіп, әлемдік ұлы істерде танытып, ұлтымызды топтасуға жігерлендіріп, өркениетті елдердің қатарына кірмейінше тәуелсіз мемлекет құра алмайтынымызды әрбір ұрпақтың санасына сіңдіру қажет. Ұлттық идеологияның осы негізгі мақсаттарының бір саласы бұқаралық ақпарат құралдарына жүктеледі. Жаңа замандағы медианың міндеті – ұлт санасының қайнар көздерін: тіл мен тарих, мәдениет пен әдет-ғұрып, салт-сана, ұлттық дәстүрлерді насихаттау. Әрбір мемлекеттің демократиялық және өркениеттілік дәрежесі ең алдымен мәдениетке көзқарасымен анықталатынын әрқашан естен шығармау; адамдарды рухани жағынан байыту, еңбектің, тұрмыстың, бос уақыттың жоғары мәдениетіне мән беру; интеллектуалды шығармашылық пен өнер арқылы тәрбиелеу басты назарда болуы тиіс.

Джеймс Картер АҚШ-тың билігі өз қолында тұрған бір кезінде «менің армияны қаруландыруға жұмсаған бір долларымнан насихатқа жұмсаған бір долларым әлдеқайда тиімді»

деген екен. Электронды насихаттың тиімділігін, болашағын, оның шекара деген кедергіні білмейтінін әруақытта естен шығармаған абзал.

Әлем халықтары салт-дәстүрін, әдет-ғұрпын, ұлттық санасын, өнерін насихаттауға жаңа ақпараттық технологияларды, медиа коммуникацияны барынша қолданып жатыр. Бүгінде бұқаралық ақпарат құралдарында ұлттық мәдениет және салт-дәстүр мәселесін жазып, көрсетіп насихаттаудың өзіндік ерекшеліктері бар. Өйткені әр халықтың ғасырлар бойы қалыптасқан рухани байлығын білу үшін көп ізденіп, көп еңбектену қажет. Бұл бұқаралық ақпарат құралдарында жұмыс істеп жүрген журналистердің басты мақсаты. Ақпарат құралдары жаңалық хабаршысы, ақпарат таратушы ғана емес, бұқараның рухани қажеттілігін өтеп, танымдық көкжиегін кеңейтетін құрал. Жаңа ғасырда оның танымдық және тәрбиелік рөлі аса зор. Баспасөз беттерінде, интернет пен электронды медиадағы халықты толғандырып отыратын қоғамдық-саяси және әлеуметтік мәселелермен қатар, руханият, мәдениет, тарих, ұлттық наным төңірегіндегі материалдар да жиі жазылады. Ұлттық сананы қалыптастырып, жастарды тәрбиелеудегі бұл тақырыптардың маңыздылығын ешкім жоққа шығара алмайды.

Жылдамдығы жоғары уақыт пен әлемдегі ғаламдасу процесі кезінде қазақ ұлтының өзін-өзі сақтауы, мәдениеті мен бет-бейнесін, тілі мен дінін, санасы мен салтын жоғалтып алмауға ұмтылысы көңілге қуаныш сыйлайды. Ұлттық тұғыр, ұлттық бағыт-бағдар мәдениет саласы үшін ғана емес, сонымен қатар бүгінде бүкіл әлем үшін ортақ категорияға, ортақ іске айналып отырған нарықтық экономика үшін де қажет. Іргелі ел болудың, қуатты мемлекет болудың ең үлкен тетігі – ұлттық экономиканы көркейте білуде жатыр. Қазіргі әлемде экономикалық саясат пен ұлт тағдыры өте тығыз байланыста. Ең алдымен ұлт тағдырын, адам тағдырын ойлап осы бағытты мықтап ұстанған экономикалық реформа шын мәнінде адам үшін, солардың әл-ауқатының, күн көрісінің деңгейін көтеру үшін ғана емес, олардың рухани өсуін, өнері мен мәдениетінің өрлеуін, оқу-білім дәрежесінің биіктеп отыруын қамтамасыз етеді [5].

Қоғамдық сана өзінің формасы жағынан төменгі және жоғары болып екі сатыға бөлінеді. Төменгі сатысына әдет-ғұрып, салт-сана, ән-күй, ойын-сауық, мақал-мәтел жатады. Оларды ешкім арнайы қалыптастырмайды. Бұлар өзінен-өзі дамиды. Сананың осы сатысын «қоғамдық психология» дейміз. Ал қоғамдық сананың жоғарғы сатысын «идеология» дейміз. Ол өздігінен пайда болмайды. Оны мемлекет бағыттайды, ғалымдар, маманданған кәсіби сарапшылар тұжырымдайды, қоғамға ұсынады, елге таратады. Бұл жерде жаңа заман медиасына артылатын жүктің салмағы ауыр екені белгілі.

Мәселен, патша үкіметі қазақ даласын Ресейге қосып алысымен жергілікті жердің, мекен-жайлардың, қалалардың, өзен-сулардың атауларын өзгертіп, орысша қоя бастады. Бұндағы мақсат – бұрынғы тарихи атауларды ұмыттырып, болашақ буынның санасына басқа ұғым қалыптастыру. Патша үкіметі бұл саясатты Кавказға, Орта Азияға, Сібірге, т.б. жерлерге қолданды. Ал соңғы кездерде сол аймақтардың бұрынғы тарихи аттарын қайтарып беру процесі жүріп жатқанда оны түсінбейтіндер табылып, реніш білдіргендер де болды. Міне, бұл не? Идеологиялық мәселе. Патша үкіметінің жүргізген саясаты бір идеология болса, қазіргі жүргізіліп жатқан саясат тарихи әділетті қалпына келтіруге деген ұмтылыс идеологиясы.

Сол сияқты көптеген қоғамдық психологияға жататын әдет-ғұрыптарға, Наурыз, айтыс, діни мейрамдарға, саяси іс-әрекеттерге қашанда идеология тұрғысынан мән беріледі. Идеология әртүрлі болғандықтан оған деген көзқарас та бір-біріне ұқсамайды. Бүгінде, бізге керегі қандай идеология, бұл жөнінде түсініксіздік етек алуда. Мәселен, кейбір адамдардың ойынша біздің идеологиямыз ұлттық болуы керек. Бұл сонау Асан қайғыдан басталып, Шортанбай, Дулат, Абай одан бүгінге дейінгі қазақ зиялыларының пікірлерін қамтуы тиіс дегенге саяды. Әрине, олардың айтқан сөздері идеологияға жатады. Өйткені бұл адамдар қазақтың елдігін жырлады. Бірақ жаңа заманда бізге керегі – ұлтшыл емес, ұлтжанды, халықтық, ғылыми идеология.

Ұлттық идеология жалпыадамзаттық идеологияның бір тармағы түрінде қалыптасқаны жөн. Жалпы адамгершілік, достық идеологиясын барлық халықтар қолдайды. Ал соның ішінде ұлттық идеология біздің республикамыздың тарихи, мәдени ерекшеліктерін айқындайтын болуы тиіс. Біздің басты ұлттық идеологиямыз егемендігімізді, тәуелсіздігімізді сақтау, біреудің ықпалында кетпеу, халықтың намысын жандыру, саяси санасын ояту. Егемен ел болған соң өзімізге артылған жауапкершілікті сезініп, басқа халықтардың да жағдайын ойлап, бірлікте болу.

Қорытынды

Іргелі халық, ұлт болып қалыптасу үшін де өзін-өзі танып білу шарт. Ұлттық дамуда міндетті түрде ұлттық сын болуы қажет. Олай болмаған жағдайда кез-келген ұлт ескіше

ойлаудан аса алмай, рухани дамудың, өркениеттің соңында қалып қалуы мүмкін. Жаңаша қимыл, жаңаша ойлау бүгінде өте маңызды.

Жаңаша ойлау дегеніміз – қоғамдық сананың прогрессивті көрінісі. Әр заманның өзінше ойлау жүйесі болған. Әйтпегенде адамзат тарихы болмақ емес. Жаңаша ойлау туралы әлемге әйгілі философ Бертран Рассел 1954 жылы 23 желтоқсанда Ұлыбритания радиосынан былай деп сөйлеген еді: «Мен сіздердің алдарыңызда ағылшын да, еуропалық та немесе Батыс демократиясының өкілі де емес, бұдан әрі өмір сүруіне қатер төнген адамзат ұрпағының өкілі ретінде сөйлеп тұрмын. Бүкіл әлем қайшылықтарға толы: дүниеде арабтар мен еврейлер, үнділер мен пакистандықтар, Африкада ақ нәсілдер мен негрлер, қала берді, коммунизм мен антикоммунизм арасында алапат тартыстар жүріп жатыр. Әрбір саяси саналы адам қазіргі жағдайда, мүмкіндік болғанынша, осы қарама-қарсы күштердің бір жағына шығып кетпей, тамаша биологиялық тарихы бар жан иесінің өкілі ретінде іс-әрекет жасап өзінің жойылып кетпеуіне күш жұмсауы керек. Біздің жаңаша ойлауға үйренуіміз аса қажет». Жаңаша ойлау жүйесін біздің елде саяси бағыт ретінде қабылдауы, оны іске асыруға деген талпыныс қазақ ұлты үшін, оның өз болмысын тану үшін қолайлы жағдай туғызып отырғаны қуантады.

Уақыт атты ұлылықтың еншісіне байланған пенде біткеннің бәрі де өмірден өз орнын, өз биіктігін іздеп әлек. Бәріне де уақыт сыншы. Қарама-қайшылыққа толы әлемде әрбір ұлт, әрбір мемлекет, әрбір қоғам өзінің ерекшеліктерін, қоғамда қалыптасқан дәстүрлерін сақтауға, рухани қазынасын байытуға тырысуда. Рухани үйлесім – адамзат пен бүгінгі уақыттың көркем шежіресіне айналып отыр. Сондықтан оның бүкіл табиғаты, мақсат-мүддесі заман сипаты мен талабынан тыс бола алмайды.

Ұлттың мәдениеті мен тілінің дамуын мазмұнды, жан-жақты, ғылыми тұрғыдан талқылау да шыншылдықты, әділетті, түрлі ой-пікірлердің ынтымағын қажет ететін, жаңа дәуір үрдісінен туындап отырған талап.

Қаржыландыру

Бұл зерттеу мақаласы ҚР Ғылым және жоғары білім министрлігі Ғылым комитетінің ғылыми гранты есебінен қаржыландырылды (грант №AP19677579).

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Mathematical sciences

QUALITATIVE STUDY OF A STOCHASTIC RUMOR SPREADING MODEL WITH THE DIFFERENT ATTITUDES TOWARDS RUMORS

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Abstract

In this paper, a stochastic rumor spreading model with the different attitudes towards rumors is investigated. First of all, we prove that the system has a unique global positive solution. Then by constructing appropriate stochastic Lyapunov functions, we establish sufficient conditions for the ergodic stationary distribution of the stochastic model. Furthermore, sufficient conditions for the extinction and persistence in the mean of the rumors are obtained. Eventually, numerical simulations are carried out in order to support our analytical results.

Keywords *Stochastic rumor spreading model, Ito's formula, Stationary distribution, Extinction, Persistence*

1 Introduction

As everyone knows, rumors are usually called as opinions and statements that have not been officially verified and are quickly propagated by all kinds of mediums. They have generally something to do with the accidents or problems which the people care about. It goes without saying that rumors make a great difference to the public's daily life. In addition, their wide propagation can give rise to social panic and also easily make the society unstable [1].

In order to better do a research on the dynamic characteristic of the rumor spread, we often choose to use epidemic models because the process of rumor propagation is similar to the spread of infectious diseases. For the first time, Daley and Kendall [2, 3] came up with a classical model for the transmission of rumors, which was later called the DK model. Then Maki and Thompson [4] further expanded the DK model on the basis of the study of rumor transmission, which was later named the MT model. After that, many researchers have made modifications and supplements for the rumor propagation model. So numerous innovative rumor propagation models have constantly appeared. For instance, Zhu et al study the local and global stability as well as the optimal control of the SEIR rumor spreading model in the literature [5]. Thereinto, the acronyms SEIR represent the number of online social network users whose news columns have not yet received the rumor(S), whose news columns have received the rumor but individuals might not noticed(E), who have believed in the rumor(I), who have been exposed to rumor for a period of time but do not believe in it(R), respectively. Liu et al [6] establish and study a mathematical model describing the propagation of information including rumor and truth. Jia et al [7] present an improved SIR model and establish the corresponding mean-field equation. Thereinto, the acronyms SIR represent the susceptible people have not received the rumor(S), the infected people have received and spread the rumor(I), the recovered people have received the rumor but never spread it(R), respectively. Wang et al [8] come up with a misinformation spreading model for temporal networks and verify the effectiveness of a heuristic-containing strategy. Wang et al [9] present the recent progress in the study of coevolution spreading dynamics and introduce epidemic-resources in detail, in addition, also discuss the challenges in this field as well as open issues for future studies. Nevertheless, the majority of the previous investigations neglect the influence that the people are likely to show different attitudes when faced with rumors. For the sake of making the course of rumor propagation more rational and suasive, Hu

et al designed a rumor spreading model with the different attitudes towards rumors in [10], the model is as follows

$$\begin{cases} \dfrac{dS(t)}{dt} = m - \alpha S(t)I(t) - \mu S(t), \\ \dfrac{dH(t)}{dt} = \beta_1 \alpha S(t)I(t) - \eta H(t) - \mu H(t), \\ \dfrac{dI(t)}{dt} = \beta_2 \alpha S(t)I(t) + \gamma\eta H(t) - \delta I(t) - \mu I(t), \\ \dfrac{dR(t)}{dt} = (1-\beta_1-\beta_2)\alpha S(t)I(t) + (1-\gamma)\eta H(t) + \delta I(t) - \mu R(t), \end{cases} \tag{1.1}$$

where $S(t)$, $H(t)$, $I(t)$, $R(t)$ represent a group of susceptible people having never heard the rumors, the hesitating people having heard about rumors but being hesitated whether to believe in rumors, the influenced people being willing to propagate rumors, the resistent people being conscious of them but never spreading them, respectively. In addition, the meaning of each parameter is shown as follows

- m *is the number of individuals entering in the whole group per unit time;*
- α *is the rate of spreading rumors;*
- μ *is the rate of moving out for each class of people;*
- $\beta_1 \in (0,1)$ *is the rate of transforming susceptible individuals into hesitating individuals;*
- $\beta_2 \in (0,1)$ *means the rate of converting susceptible individuals into influenced individuals;*
- η *is progression rate that hesitating individuals are turned into affected individuals or resistant individuals;*
- γ *expresses the rate that hesitating individuals are changed to affected individuals;*
- δ *is the ratio that affected individuals become resistant individuals.*

These parameters all are positive constant above. According to the theory in [10], system (1.1) has the following properties:

(i) $\Gamma = \left\{ (S(t), H(t), I(t), R(t)) \in R_+^4 : S(t) + H(t) + I(t) + R(t) \le \dfrac{m}{\mu} \right\}$ *is positively invariant for the system (1.1). The basic reproductive number is defined as* $R_0 = \dfrac{\alpha m[\beta_2(\mu+\eta) + \beta_1\gamma\eta]}{\mu(\mu+\delta)(\mu+\eta)}$.

(ii) The rumor-free equilibrium $E_0\left(\dfrac{m}{\mu}, 0, 0\right)$, *which always exists, is globally asymptotically stable if* $R_0 \le 1$.

(iii) When $R_0 > 1$, *system (1.1) has a unique rumor existence equilibrium* $E_*(S_*, H_*, I_*, R_*)$ *satisfies*

$$S_* = \frac{m}{\mu R_0}, H_* = \frac{\beta_1 m(R_0 - 1)}{R_0(\mu+\eta)}, I_* = \frac{\mu}{\alpha}(R_0 - 1),$$

$$R_* = (R_0 - 1)\left[\frac{(1-\beta_1-\beta_2)m}{\mu R_0} + \frac{(1-\gamma)\eta\beta_1}{(\mu+\eta)\mu R_0} + \frac{\delta}{\alpha}\right],$$

and it is globally asymptotically stable.

Now, when describing the spread of infectious diseases, most of the research is based on the establishment of a deterministic mathematical model of certain infectious diseases. It is convenient for us to simplify complex problems. However, in the real world, there is no doubt that the biological-mathematic models will be influenced by environmental noise [11–14]. Therefore, so as to have a more clear knowledge of the dynamics characteristic of the epidemics system, we had better to take advantage of stochastic differential equations models. Based on this condition, many authors prefer to investigate the models that possess stochastic perturbations(see, e.g.[15–19]). About these literatures that study the dynamics nature of a stochastic rumor spreading model, we can refer to [19–21] and so on.

It is vital to embody how the environmental noise influence on the rumor model. However, to the best of our knowledge, few papers discuss the existence of an ergodic stationary distribution for a stochastic rumor spreading model with the different attitudes towards rumors. Enlightened by the idea that the authors in [19, 20] make the assumption that stochastic perturbations use the form of the white noise and they are directly proportional to the rumor susceptible users $(S(t))$ *and the rumor infected users* $(I(t))$*. The stochastic version corresponding to system (1.1) has the following form*

$$\begin{cases} dS(t) = [m - \alpha S(t)I(t) - \mu S(t)]dt + \sigma_1 S(t)dB_1(t), \\ dH(t) = [\beta_1 \alpha S(t)I(t) - \eta H(t) - \mu H(t)]dt + \sigma_2 H(t)dB_2(t), \\ dI(t) = [\beta_2 \alpha S(t)I(t) + \gamma\eta H(t) - \delta I(t) - \mu I(t)]dt + \sigma_3 I(t)dB_3(t), \\ dR(t) = [(1-\beta_1-\beta_2)\alpha S(t)I(t) + (1-\gamma)\eta H(t) + \delta I(t) - \mu R(t)]dt + \sigma_4 R(t)dB_4(t), \end{cases} \quad (1.2)$$

where $B_i(t), t = 1,2,3,4$ *are the white noises, that is,* $B = (B_1(t), B_2(t), B_3(t), B_4(t), t \geq 0)$ *is mutually independent standard Brownian motions defined on a complete probability space* (Ω, F, P) *with a filtration* $\{F_t\}_{t\geq 0}$ *according with the general conditions (i.e., it is increasing and right continuous while* F_0 *contains all P-null sets),* $\sigma_1, \sigma_2, \sigma_3, \sigma_4$ *express the intensities of the white noise and* $\sigma_i > 0 (i = 1,2,3,4)$*. All the other parameters have the same meaning as that of the system (1.1).*

This paper is organized as following: In the next section, we prove that there exists a unique global positive solution of system (1.2) for any initial value. In Section 3, we will deduce the existence of the ergodic stationary distribution of the stochastic model. In section 4, we obtain the conditions of the extinction and persistence for stochastic system (1.2). In the end, the numerical simulations are carried out in Section 5 to verify the main theoretical results. A brief discussion is given in last part to conclude this work.

2 Existence and uniqueness of the global positive solution

In this section, it is verified that the solution of system (1.2) is global and positive for any initial value. As is well-known, if we want to prove that a stochastic differential equation exists a unique global solution (i.e., no explosion at any finite time) to the system (1.2) for any initial value, generally speaking, the coefficients of the system have to accord with the linear growth condition and local Lipschitz condition(see [12]). Because the coefficients of system (1.2) have continuous partial derivatives of first order with respect to $S(t), H(t), I(t), R(t)$*. Therefore, the coefficients of system (1.2) are locally Lipschitz continuous. In addition, the coefficients of system (1.2) do not satisfy monotone condition, so they also do not satisfy the linear growth condition. Hence the solution of system (1.2) may explode at a finite time. In the following, we will deduce that there is a unique global positive solution of system (1.2) for any initial value.*

Theorem 2.1 *For any initial value* $(S(0), H(0), I(0), R(0)) \in R_+^4$*, there is a unique positive solution* $(S(t), H(t), I(t), R(t))$ *on* $t \geq 0$ *for system (1.2), in addition, the solution will remain in* R_+^4 *with probability one, that is,* $(S(t), H(t), I(t), R(t)) \in R_+^4$ *for all* $t \geq 0$ *almost surely (a.s).*

Proof. *Since the coefficients of system (1.2) conform to locally Lipschitz condition, so system (1.2) for any initial value has a unique local solution* $(S(0), H(0), I(0), R(0))$ *on* $t \in [0, \tau_e)$*, where* τ_e *is the explosion time [22]. Next if we want to illustrate that this solution is global, it is vital for us to verify that* $\tau_e = \infty$ *a.s.. At this time, let* $k_0 \geq 1$ *be enough large such that* $S(0), H(0), I(0), R(0)$ *all lie within the interval* $[\frac{1}{k_0}, k_0]$*. For each integer* $k \geq k_0$ *, define the stopping time* $\tau_k = \inf\{t \in [0, \tau_e) : S(t) \notin (\frac{1}{k}, k)$ *or* $H(t) \notin (\frac{1}{k}, k)$ *or* $I(t) \notin (\frac{1}{k}, k)$ *or* $R(t) \notin (\frac{1}{k}, k)\}$*, where throughout this paper, we set inf* $\varnothing = \infty$ *(as usual* $\varnothing$ *is the empty set). Clearly* τ_k *is increasing when* $k \to \infty$*. Let* $\tau_\infty = \lim_{k\to\infty} \tau_k$*, whence* $\tau_\infty \leq \tau_e$ *a.s. If we can express*

$\tau_\infty = \infty$, *then* $\tau_\infty = \infty$ *and* $(S(t), H(t), I(t), R(t)) \in R_+^4$ *a.s. for all* $t \geq 0$. *That means that we are asked to illustrate that* $\tau_\infty = \infty$ *a.s. in order to finish the proof. If this assertion is not true, then there is a pair of constants* $T > 0$ *and* $\varepsilon \in (0,1)$ *such that*

$$P\{\tau_\infty \leq T\} > \varepsilon .$$

Hence there is an integer $k_1 \geq k_0$ *such that for all* $k \geq k_1$

$$P\{\tau_k \leq T\} \geq \varepsilon . \qquad (2.1)$$

Define a C^2*— function* $V : R_+^4 \to R_+$ *by*

$$V(S,H,I,R) = (S - b - b\ln\frac{S}{b}) + (H - 1 - \ln H) + (I - 1 - \ln I) + (R - 1 - \ln R) .$$

where b *is a positive constant to be determined later. The nonnegativity of this function can be attained from* $u - 1 - \ln u \geq 0$ *for any* $u > 0$. *Using Itô formula to* V, *we get:*

$$\begin{aligned} dV &= (1-\frac{b}{S})dS + (1-\frac{1}{H})dH + (1-\frac{1}{I})dI + (1-\frac{1}{R})dR \\ &\quad + \frac{1}{2}\frac{b}{S^2}(dS)^2 + \frac{1}{2}\frac{1}{H^2}(dH)^2 + \frac{1}{2}\frac{1}{I^2}(dI)^2 + \frac{1}{2}\frac{1}{R^2}(dR)^2 \\ &= (1-\frac{b}{S})[m - \alpha SI - \mu S]dt + \sigma_1 S dB_1(t)] + \frac{1}{2}b\sigma_1^2 dt \\ &\quad + (1-\frac{1}{H})[(\beta_1 \alpha SI - \eta H - \mu H)dt + \sigma_2 H dB_2(t)] + \frac{1}{2}\sigma_2^2 dt \\ &\quad + (1-\frac{1}{I})[(\beta_2 \alpha SI + \gamma\eta H - \delta I - \mu I)dt + \sigma_3 I dB_3(t)] + \frac{1}{2}\sigma_3^2 dt \\ &\quad + (1-\frac{1}{R})[((1-\beta_1-\beta_2)\alpha SI + (1-\gamma)\eta H + \delta I - \mu R)dt + \sigma_4 R dB_4(t)] + \frac{1}{2}\sigma_4^2 dt \\ &= LVdt + \sigma_1(S-b)dB_1(t) + \sigma_2(H-1)dB_2(t) + \sigma_3(I-1)dB_3(t) + \sigma_4(R-1)dB_4(t). \end{aligned}$$

where LV *is defined by*

$$\begin{aligned} LV &= (1-\frac{b}{S})(m - \alpha SI - \mu S) + \frac{1}{2}b\sigma_1^2 + (1-\frac{1}{H})(\beta_1 \alpha SI - \eta H - \mu H) \\ &\quad + \frac{1}{2}\sigma_2^2 + (1-\frac{1}{I})(\beta_2 \alpha SI + \gamma\eta H - \delta I - \mu I) + \frac{1}{2}\sigma_3^2 + (1-\frac{1}{R})[(1-\beta_1-\beta_2)\alpha SI \\ &\quad + (1-\gamma)\eta H + \delta I - \mu R] + \frac{1}{2}\sigma_4^2 \\ &= m - (\mu + \beta_2\alpha)S - \frac{bm}{S} - \mu H - \frac{\beta_1 \alpha SI}{H} - \frac{\gamma\eta H}{I} - \mu R - \frac{(1-\beta_1-\beta_2)\alpha SI}{R} - \frac{(1-\gamma)\eta H}{R} - \frac{\delta I}{R} \\ &\quad + (b\alpha - \mu)I + (b+3)\mu + \eta + \delta + \frac{1}{2}b\sigma_1^2 + \frac{1}{2}\sigma_2^2 + \frac{1}{2}\sigma_3^2 + \frac{1}{2}\sigma_4^2 \\ &\leq m + (b\alpha - \mu)I + (b+3)\mu + \eta + \delta + \frac{1}{2}b\sigma_1^2 + \frac{1}{2}\sigma_2^2 + \frac{1}{2}\sigma_3^2 + \frac{1}{2}\sigma_4^2. \end{aligned}$$

We choose $b = \frac{\mu}{\alpha}$ *such that* $(b\alpha - \mu)I = 0$, *then we can attain*

$$LV \leq m + (b+3)\mu + \eta + \delta + \frac{1}{2}b\sigma_1^2 + \frac{1}{2}\sigma_2^2 + \frac{1}{2}\sigma_3^2 + \frac{1}{2}\sigma_4^2 := K .$$

in which K *is a positive constant. So we hav*

$$dV \leq Kdt + \sigma_1(S-b)dB_1(t) + \sigma_2(H-1)dB_2(t) + \sigma_3(I-1)dB_3(t) + \sigma_4(R-1)dB_4(t) \qquad (2.2)$$

Integrating of (2.2) from 0 to $\tau_K \wedge T$ *and then taking the expectation on both sides, further according to Theorem 1.5.8 (ii) [22], we can obtain:*

$$EV(S(\tau_k \wedge T), H(\tau_k \wedge T), I(\tau_k \wedge T), R(\tau_k \wedge T)) \le V(S(0), H(0), I(0), R(0)) + KE(\tau_k \wedge T).$$

where $\tau_k \wedge T = \min\{\tau_k, T\}$. *Therefore,*

$$EV(S(\tau_k \wedge T), H(\tau_k \wedge T), I(\tau_k \wedge T), R(\tau_k \wedge T)) \le V(S(0), H(0), I(0), R(0)) + KT. \quad (2.3)$$

Set $\Omega_k = \{\tau_k \le T\}$ *for* $k \ge k_1$ *and by means of (2.1), we can obtain* $P(\Omega_k) \ge \varepsilon$. *Notice that for every* $\omega \in \Omega_k$, *there exists that* $S(\tau_k, \omega)$ *or* $H(\tau_k, \omega)$ *or* $I(\tau_k, \omega)$ *or* $R(\tau_k, \omega)$ *equals either* k *or* $\frac{1}{k}$. *Therefore,* $V(S(\tau_k, \omega), H(\tau_k, \omega), I(\tau_k, \omega), R(\tau_k, \omega))$ *is no less than either* $k - 1 - \ln k$ *or* $\frac{1}{k} - 1 + \ln k$.

Consequently, we have

$$V(S(\tau_k, \omega), H(\tau_k, \omega), I(\tau_k, \omega), R(\tau_k, \omega)) \ge (k - 1 - \ln k) \wedge (\frac{1}{k} - 1 + \ln k) := N(k).$$

According to (2.3), we can attain:

$$\begin{aligned} V(S(0), H(0), I(0), R(0)) + KT &\ge E(I_{\Omega_K}(\omega) V(S(\tau_k \wedge T), H(\tau_k \wedge T), I(\tau_k \wedge T), R(\tau_k \wedge T)) \\ &\ge P(\Omega_k(\omega)) N(k) \\ &\ge \varepsilon N(k), \end{aligned}$$

where I_{Ω_K} *is the indicator function of* Ω_K. *Letting* $k \to \infty$, *then*

$$\infty > V(S(0), H(0), I(0), R(0)) + KT \ge \varepsilon N(k) \to \infty,$$

which lead to the contradiction. Thus the proof is completed.

3 Existence of ergodic stationary distribution of system (1.2)

In this section, we will show the conditions of the existence of ergodic stationary distribution of system (1.2) by means of method of Khasminskii [23]. Next, we introduce some theories about stationary distributions, which is indispensable in the process of our proof.

If $X(t)$ *is a regular time-homogeneous Markov process in the d-dimensional space* E_d, *and satisfy the following stochastic equation*

$$dX(t) = b(X)dt + \sum_{r=1}^{k} g_r(X) dB_r(t).$$

Then, the diffusion matrix has the following form

$$A(X) = (a_{ij}(x)), a_{ij}(x) = \sum_{r=1}^{k} g_r^i(x) g_r^j(x).$$

Lemma 3.1*(see [23]) For Markov process* $X(t)$, *there is a unique ergodic stationary distribution* $\pi(\cdot)$ *if it exists a bounded domain* $D \in E_d$ *with regular boundary* Γ *and*

(H1)there exists a constant $M > 0$ *satisfying* $\sum_{i,j=1}^{d} a_{ij}(x)\xi_i\xi_j \ge M|\xi|^2, x \in D, \xi \in R^d$.

(H2)there is a C^2- *function* $V \ge 0$ *such that* LV *is negative for any given* $E_d \setminus D$. *Then*

$$P\{\limsup_{T\to\infty} \frac{1}{T}\int_0^T f(X(t))dt = \int_{E_d} f(x)\pi(dx)\} = 1,$$

for all $x \in E_d$, *where* $f(\cdot)$ *is an integrable function about the measure* π.

Theorem 3.1 *Assume that*

$$R_0^S := \frac{\beta_2 \alpha m}{(\mu + \frac{1}{2}\sigma_1^2)(\delta + \mu + \frac{1}{2}\sigma_3^2)} + \frac{\alpha\beta_1 m\gamma\eta}{(\mu + \frac{1}{2}\sigma_1^2)(\delta + \mu + \frac{1}{2}\sigma_2^2)(\delta + \mu + \frac{1}{2}\sigma_3^2)} > 1,$$

then there is a unique stationary distribution $\pi(\cdot)$ *for the system (1.2) and the ergodicity holds.*

Proof. *For the sake of proving Theorem 3.1, we have to verify the conditions of Lemma 3.1.First of all, we will verify that the condition (H2) in Lemma 3.1 is valid.*

Define

$$V_1 = -\ln I - (a_1 + b_1)\ln S - c_1 \ln H\,,$$

$$V_2 = -\ln S - \ln H - \ln R\,,$$

$$V_3 = \frac{1}{\theta+1}(S+H+I+R)^{\theta+1},$$

where a_1, b_1, c_1 *are positive constants to be determined later.* $\theta \in (0,1)$ *satisfy*

$$\mu - \frac{\theta}{2}(\sigma_1^2 \vee \sigma_2^2 \vee \sigma_3^2 \vee \sigma_4^2) > 0\,.$$

Using the Itô formula, we can obtain

$$\begin{aligned} LV_1 &= -\beta_2\alpha S - \frac{\gamma\eta H}{I} + \delta + \mu + \frac{1}{2}\sigma_3^2 - \frac{ma_1}{S} + a_1(\mu + \frac{1}{2}\sigma_1^2) + a_1\alpha I \\ &\quad - \frac{mb_1}{S} + b_1(\mu + \frac{1}{2}\sigma_1^2) + b_1\alpha I - \frac{\beta_1 c_1 \alpha SI}{H} + c_1(\eta + \mu + \frac{1}{2}\sigma_2^2) \\ &= -\beta_2\alpha S - \frac{ma_1}{S} + a_1(\mu + \frac{1}{2}\sigma_1^2) - \frac{\gamma\eta H}{I} - \frac{mb_1}{S} - \frac{\beta_1 c_1 \alpha SI}{H} \\ &\quad + b_1(\mu + \frac{1}{2}\sigma_1^2) + c_1(\eta + \mu + \frac{1}{2}\sigma_2^2) + \delta + \mu + \frac{1}{2}\sigma_3^2 + (a_1 + b_1)\alpha I \\ &\le -2\sqrt{\beta_2\alpha m a_1} + a_1(\mu + \frac{1}{2}\sigma_1^2) - 3\sqrt[3]{\gamma\eta m\beta_1\alpha b_1 c_1} + b_1(\mu + \frac{1}{2}\sigma_1^2) \\ &\quad + c_1(\eta + \mu + \frac{1}{2}\sigma_2^2) + \delta + \mu + \frac{1}{2}\sigma_3^2 + (a_1 + b_1)\alpha I. \end{aligned}$$

Let

$$a_1 = \frac{\beta_2\alpha m}{(\mu + \frac{1}{2}\sigma_1^2)^2}, b_1 = \frac{\alpha\beta_1 m\gamma\eta}{(\mu + \frac{1}{2}\sigma_1^2)^2(\delta + \mu + \frac{1}{2}\sigma_2^2)}, c_1 = \frac{\alpha\beta_1 m\gamma\eta}{(\mu + \frac{1}{2}\sigma_1^2)(\delta + \mu + \frac{1}{2}\sigma_2^2)^2}$$

Then we get

$$\begin{aligned} LV_1 &\le -\frac{\beta_2\alpha m}{\mu + \frac{1}{2}\sigma_1^2} - \frac{\alpha\beta_1 m\gamma\eta}{(\mu + \frac{1}{2}\sigma_1^2)(\eta + \mu + \frac{1}{2}\sigma_2^2)} + \delta + \mu + \frac{1}{2}\sigma_3^2 + (a_1 + b_1)\alpha I \\ &= -(\delta + \mu + \frac{1}{2}\sigma_3^2)(R_0^S - 1) + (a_1 + b_1)\alpha I \qquad (3.1) \\ &=: -\lambda + (a_1 + b_1)\alpha I. \end{aligned}$$

where

$$\lambda = (\delta + \mu + \frac{1}{2}\sigma_3^2)(R_0^S - 1) > 0$$

Also, we can see

$$\begin{aligned} LV_2 &\le -\frac{m}{S} - \frac{\beta_1\alpha SI}{H} - \frac{(1-\beta_1-\beta_2)\alpha SI}{R} - \frac{(1-\gamma)\eta H}{R} - \frac{\delta I}{R} + \alpha I \\ &\quad + 3\mu + \eta + \frac{1}{2}\sigma_1^2 + \frac{1}{2}\sigma_2^2 + \frac{1}{2}\sigma_4^2 \qquad (3.2) \\ &\le -\frac{m}{S} - \frac{\beta_1\alpha SI}{H} - \frac{\delta I}{R} + \alpha I + 3\mu + \eta + \frac{1}{2}\sigma_1^2 + \frac{1}{2}\sigma_2^2 + \frac{1}{2}\sigma_4^2. \end{aligned}$$

$$LV_3 = (S+H+I+R)^{\theta}[m-\mu(S+H+I+R)]+\frac{\theta}{2}(S+H+I+R)^{\theta-1}$$
$$\times(\sigma_1^2S^2+\sigma_2^2H^2+\sigma_3^2I^2+\sigma_4^2R^2)$$
$$=m(S+H+I+R)^{\theta}-\mu(S+H+I+R)^{\theta+1}+\frac{\theta}{2}(S+H+I+R)^{\theta-1}$$
$$\times(\sigma_1^2S^2+\sigma_2^2H^2+\sigma_3^2I^2+\sigma_4^2R^2) \qquad (3.3)$$
$$\le m(S+H+I+R)^{\theta}-[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)](S+H+I+R)^{\theta+1}$$
$$\le B-\frac{1}{2}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)](S+H+I+R)^{\theta+1}$$
$$\le B-\frac{1}{2}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)](S^{\theta+1}+H^{\theta+1}+I^{\theta+1}+R^{\theta+1}).$$

where

$$B=\sup_{(S,H,I,R)\in R_+^4}\{m(S+H+I+R)^{\theta}-\frac{1}{2}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)](S+H+I+R)^{\theta+1}\}<\infty.$$

Defining a C^2- *function* $\hat{V}(S,H,I,R):R_+^4\to R$ *as follows*

$$\hat{V}(S,H,I,R)=MV_1+V_2+V_3$$

in which M *is a positive constant to be determined later.*
It is clear to see that

$$\liminf_{k\to\infty,(S,H,I,R)\in R_+^4\setminus U_k}\hat{V}(S,H,I,R)=+\infty,$$

at which $U_k=(\frac{1}{k},k)\times(\frac{1}{k},k)\times(\frac{1}{k},k)\times(\frac{1}{k},k)$*.So,* $\hat{V}(S,H,I,R)$ *is a continuous function processing a minimum point* $(\bar{S}_0,\bar{H}_0,\bar{I}_0,\bar{R}_0)$ *in the interior of* R_+^4*.*

Hence, we can define a non-negative C^2-*function* $V(S,H,I,R):R_+^4\to R$ *as follows*

$$V(S,H,I,R)=\hat{V}(S,H,I,R)-\hat{V}(\bar{S}_0,\bar{H}_0,\bar{I}_0,\bar{R}_0).$$

By means of (3.1),(3.2) and (3.3), we see that

$$LV\le -M\lambda+M(a_1+b_1)\alpha I-\frac{m}{S}-\frac{\beta_1\alpha SI}{H}-\frac{\delta I}{R}+\alpha I+3\mu+\eta+\frac{\sigma_1^2+\sigma_2^2+\sigma_4^2}{2}$$
$$+B-\frac{1}{2}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)](S^{\theta+1}+H^{\theta+1}+I^{\theta+1}+R^{\theta+1})$$
$$=:-M\lambda-\frac{m}{S}-\frac{\beta_1\alpha SI}{H}-\frac{\delta I}{R}+\alpha[M(a_1+b_1)+1]I+C(S,H,I,R).$$

where

$$C(S,H,I,R)=3\mu+\eta+\frac{\sigma_1^2+\sigma_2^2+\sigma_4^2}{2}+B-\frac{1}{2}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)](S^{\theta+1}+H^{\theta+1}+I^{\theta+1}+R^{\theta+1}).$$

Let M *is a positive constant and satisfy*

$$-M\lambda+F\le -2, \qquad (3.4)$$

where

$$F=\sup_{(S,H,I,R)\in R_+^4}C(S,H,I,R)<\infty.$$

Now, we define a bounded closed set as follows

$$D_\varepsilon=\{(S,H,I,R)\in R_+^4:\varepsilon\le S\le\frac{1}{\varepsilon},\varepsilon^3\le H\le\frac{1}{\varepsilon^3},\varepsilon\le I\le\frac{1}{\varepsilon},\varepsilon^2\le R\le\frac{1}{\varepsilon^2}\}.$$

at which $\varepsilon>0$ *is a sufficiently small positive constant conforming to the following inequalities*

$$-\frac{m}{\varepsilon}+D\le -1\ . \qquad (3.5)$$

$$-\frac{\beta_1\alpha}{\varepsilon}+D\le -1\ . \qquad (3.6)$$

$$-M\lambda+\alpha[M(a_1+b_1)+1]\varepsilon+F\le -1. \qquad (3.7)$$

$$-\frac{\delta}{\varepsilon}+D\le -1. \quad (3.8)$$

$$-\frac{1}{4}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)]\frac{1}{\varepsilon^{\theta+1}}+G\le -1. \quad (3.9)$$

$$-\frac{1}{4}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)]\frac{1}{\varepsilon^{3(\theta+1)}}+Q\le -1. \quad (3.10)$$

$$-\frac{1}{4}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)]\frac{1}{\varepsilon^{\theta+1}}+U\le -1. \qquad (3.11)$$

$$-\frac{1}{4}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)]\frac{1}{\varepsilon^{2(\theta+1)}}+P\le -1. \qquad (3.12)$$

where G,Q,U,P *are all positive constants according with the equations (3.19),(3.21),(3.23),(3.25).*

Therefore, $R_+^4\setminus D_\varepsilon$ *can be divided into eight domains*

$$D_1=\{(S,H,I,R)\in R_+^4,0<S<\varepsilon\},D_2=\{(S,H,I,R)\in R_+^4,0<H<\varepsilon^3,S\ge\varepsilon,I\ge\varepsilon\},$$

$$D_3=\{(S,H,I,R)\in R_+^4,0<I<\varepsilon\},D_4=\{(S,H,I,R)\in R_+^4,0<R<\varepsilon^2,I\ge\varepsilon\},$$

$$D_5=\{(S,H,I,R)\in R_+^4,S>\frac{1}{\varepsilon}\},\quad D_6=\{(S,H,I,R)\in R_+^4,H>\frac{1}{\varepsilon^3}\},$$

$$D_7=\{(S,H,I,R)\in R_+^4,I>\frac{1}{\varepsilon}\},\quad D_8=\{(S,H,I,R)\in R_+^4,R>\frac{1}{\varepsilon^2}\}.$$

Next we will show $LV(S,H,I,R)\le -1$ *for any given* $(S,H,I,R)\in R_+^4\setminus D_\varepsilon$.

Case 1. If $(S,H,I,R)\in D_1$, *then we get that*

$$\begin{aligned}LV&\le -\frac{m}{S}+\alpha[M(a_1+b_1)+1]I+C(S,H,I,R)\\&\le -\frac{m}{\varepsilon}+D.\end{aligned} \qquad (3.13)$$

where

$$D=\sup_{(S,H,I,R)\in R_+^4}\{\alpha[M(a_1+b_1)+1]I+C(S,H,I,R)\}<\infty. \qquad (3.14)$$

It is easy for us to see that $LV(S,H,I,R)\le -1$ *for any* $(S,H,I,R)\in D_1$ *in virtue of (3.5).*

Case 2. If $(S,H,I,R)\in D_2$, *then we have that*

$$\begin{aligned}LV&\le -\frac{\beta_1\alpha SI}{H}+\alpha[M(a_1+b_1)+1]I+C(S,H,I,R)\\&\le \frac{\beta_1\alpha}{\varepsilon}+D.\end{aligned} \qquad (3.15)$$

According to (3.6), the conclusion that $LV(S,H,I,R)\le -1$ *for any* $(S,H,I,R)\in D_2$ *is true.*

Case 3. If $(S,H,I,R)\in D_3$, *then we see that*

$$\begin{aligned}LV&\le -M\lambda+\alpha[M(a_1+b_1)+1]I+C(S,H,I,R)\\&\le -M\lambda+\alpha[M(a_1+b_1)+1]\varepsilon+F.\end{aligned} \qquad (3.16)$$

From(3.7), we obtain the conclusion that $LV(S,H,I,R)\le -1$ *for any*$(S,H,I,R)\in D_3$.

Case 4. If $(S,H,I,R)\in D_4$, *then we attain tha*

$$\begin{aligned} LV &\le -\frac{\delta I}{R}+\alpha[M(a_1+b_1)+1]I+C(S,H,I,R) \\ &\le -\frac{\delta}{\varepsilon}+D. \end{aligned} \tag{3.17}$$

It is evident that $LV(S,H,I,R)\le -1$ *for any given* $(S,H,I,R)\in D_4$ *by (3.8).*

Case 5. If $(S,H,I,R)\in D_5$, *then we arrive at*

$$\begin{aligned} LV &\le -\frac{1}{4}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)]S^{\theta+1}-\frac{1}{4}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)]S^{\theta+1}+3\mu+\eta+\frac{\sigma_1^2+\sigma_2^2+\sigma_4^2}{2} \\ &\quad +B+\alpha[M(a_1+b_1)+1]I-\frac{1}{2}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)](H^{\theta+1}+I^{\theta+1}+R^{\theta+1}) \\ &\le -\frac{1}{4}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)]S^{\theta+1}+G \\ &\le -\frac{1}{4}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)]\frac{1}{\varepsilon^{\theta+1}}+G. \end{aligned} \tag{3.18}$$

where

$$\begin{aligned} G=\sup_{(S,H,I,R)\in R_+^4}\{&-\frac{1}{4}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)]S^{\theta+1}+3\mu+\eta+\frac{\sigma_1^2+\sigma_2^2+\sigma_4^2}{2} \\ &+B+\alpha[M(a_1+b_1)+1]I-\frac{1}{2}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)](H^{\theta+1}+I^{\theta+1}+R^{\theta+1})\}<\infty. \end{aligned}$$

(3.19)

With the help of (3.9), the result $LV(S,H,I,R)\le -1$ *for any* $(S,H,I,R)\in D_5$ *is right.*

Case 6. If $(S,H,I,R)\in D_6$, *then we have a conclusion as follows*

$$\begin{aligned} LV &\le -\frac{1}{4}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)]H^{\theta+1}-\frac{1}{4}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)]H^{\theta+1}+3\mu+\eta+\frac{\sigma_1^2+\sigma_2^2+\sigma_4^2}{2} \\ &\quad +B+\alpha[M(a_1+b_1)+1]I-\frac{1}{2}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)](S^{\theta+1}+I^{\theta+1}+R^{\theta+1}) \\ &\le -\frac{1}{4}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)]H^{\theta+1}+Q \\ &\le -\frac{1}{4}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)]\frac{1}{\varepsilon^{3(\theta+1)}}+Q. \end{aligned} \tag{3.20}$$

where

$$\begin{aligned} Q=\sup_{(S,H,I,R)\in R_+^4}\{&-\frac{1}{4}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)]H^{\theta+1}+3\mu+\eta+\frac{\sigma_1^2+\sigma_2^2+\sigma_4^2}{2} \\ &+B+\alpha[M(a_1+b_1)+1]I-\frac{1}{2}[\mu-\frac{\theta}{2}(\sigma_1^2\vee\sigma_2^2\vee\sigma_3^2\vee\sigma_4^2)](S^{\theta+1}+I^{\theta+1}+R^{\theta+1})\}<\infty. \end{aligned}$$

(3.21)

We draw the conclusion $LV(S,H,I,R)\le -1$ *for any* $(S,H,I,R)\in D_6$ *by feat of (3.10).*

Case 7. If $(S,H,I,R)\in D_7$, *then we get a conclusion as follows*

$$LV \le -\frac{1}{4}[\mu - \frac{\theta}{2}(\sigma_1^2 \vee \sigma_2^2 \vee \sigma_3^2 \vee \sigma_4^2)]I^{\theta+1} - \frac{1}{4}[\mu - \frac{\theta}{2}(\sigma_1^2 \vee \sigma_2^2 \vee \sigma_3^2 \vee \sigma_4^2)]I^{\theta+1} + 3\mu + \eta + \frac{\sigma_1^2 + \sigma_2^2 + \sigma_4^2}{2}$$
$$+B + \alpha[M(a_1 + b_1) + 1]I - \frac{1}{2}[\mu - \frac{\theta}{2}(\sigma_1^2 \vee \sigma_2^2 \vee \sigma_3^2 \vee \sigma_4^2)](S^{\theta+1} + H^{\theta+1} + R^{\theta+1}) \quad (3.22)$$
$$\le -\frac{1}{4}[\mu - \frac{\theta}{2}(\sigma_1^2 \vee \sigma_2^2 \vee \sigma_3^2 \vee \sigma_4^2)]I^{\theta+1} + U$$
$$\le -\frac{1}{4}[\mu - \frac{\theta}{2}(\sigma_1^2 \vee \sigma_2^2 \vee \sigma_3^2 \vee \sigma_4^2)]\frac{1}{\varepsilon^{\theta+1}} + U.$$

where

$$U = \sup_{(S,H,I,R)\in R_+^4}\{-\frac{1}{4}[\mu - \frac{\theta}{2}(\sigma_1^2 \vee \sigma_2^2 \vee \sigma_3^2 \vee \sigma_4^2)]I^{\theta+1} + 3\mu + \eta + \frac{\sigma_1^2 + \sigma_2^2 + \sigma_4^2}{2}$$
$$+B + \alpha[M(a_1 + b_1) + 1]I - \frac{1}{2}[\mu - \frac{\theta}{2}(\sigma_1^2 \vee \sigma_2^2 \vee \sigma_3^2 \vee \sigma_4^2)](S^{\theta+1} + H^{\theta+1} + R^{\theta+1})\} < \infty. \quad (3.23)$$

We have that $LV(S,H,I,R) \le -1$ *for any* $(S,H,I,R) \in D_7$ *according to(3.11).*

Case 8. If $(S,H,I,R) \in D_8$, *then we have a conclusion as follows*

$$LV \le -\frac{1}{4}[\mu - \frac{\theta}{2}(\sigma_1^2 \vee \sigma_2^2 \vee \sigma_3^2 \vee \sigma_4^2)]R^{\theta+1} - \frac{1}{4}[\mu - \frac{\theta}{2}(\sigma_1^2 \vee \sigma_2^2 \vee \sigma_3^2 \vee \sigma_4^2)]R^{\theta+1} + 3\mu + \eta + \frac{\sigma_1^2 + \sigma_2^2 + \sigma_4^2}{2}$$
$$+B + \alpha[M(a_1 + b_1) + 1]I - \frac{1}{2}[\mu - \frac{\theta}{2}(\sigma_1^2 \vee \sigma_2^2 \vee \sigma_3^2 \vee \sigma_4^2)](S^{\theta+1} + H^{\theta+1} + I^{\theta+1}) \quad (3.24)$$
$$\le -\frac{1}{4}[\mu - \frac{\theta}{2}(\sigma_1^2 \vee \sigma_2^2 \vee \sigma_3^2 \vee \sigma_4^2)]R^{\theta+1} + P$$
$$\le -\frac{1}{4}[\mu - \frac{\theta}{2}(\sigma_1^2 \vee \sigma_2^2 \vee \sigma_3^2 \vee \sigma_4^2)]\frac{1}{\varepsilon^{2(\theta+1)}} + P.$$

where

$$P = \sup_{(S,H,I,R)\in R_+^4}\{-\frac{1}{4}[\mu - \frac{\theta}{2}(\sigma_1^2 \vee \sigma_2^2 \vee \sigma_3^2 \vee \sigma_4^2)]R^{\theta+1} + 3\mu + \eta + \frac{\sigma_1^2 + \sigma_2^2 + \sigma_4^2}{2}$$
$$+B + \alpha[M(a_1 + b_1) + 1]I - \frac{1}{2}[\mu - \frac{\theta}{2}(\sigma_1^2 \vee \sigma_2^2 \vee \sigma_3^2 \vee \sigma_4^2)](S^{\theta+1} + H^{\theta+1} + I^{\theta+1})\} < \infty. \quad (3.25)$$

We see that $LV(S,H,I,R) \le -1$ *for any* $(S,H,I,R) \in D_8$ *with the aid of (3.12).*

In the end, from the discussion of a series of cases above, we attain that

$$LV(S,H,I,R) \le -1, (S,H,I,R) \in R_+^4 \setminus D_\varepsilon.$$

In the following, the diffusion matrix of system (1.2) is

$$A = \begin{pmatrix} \sigma_1^2 S^2 & 0 & 0 & 0 \\ 0 & \sigma_2^2 H^2 & 0 & 0 \\ 0 & 0 & \sigma_3^2 I^2 & 0 \\ 0 & 0 & 0 & \sigma_4^2 R^2 \end{pmatrix}$$

Let $c = \min_{(S,H,I,R)\in \bar{D}_k \subset R_+^4}\{\sigma_1^2 S^2, \sigma_2^2 H^2, \sigma_3^2 I^2, \sigma_4^2 R^2\}$, *then we have*

$$\sum_{i,j=1}^{4} a_{ij}(x)\xi_i\xi_j = \sigma_1^2 S^2 \xi_1^2 + \sigma_2^2 H^2 \xi_2^2 + \sigma_3^2 I^2 \xi_3^2 + \sigma_4^2 R^2 \xi_4^2 \ge c|\xi|^2, (S,H,I,R) \in \bar{D}_k, \xi \in R^4.$$

Hence the condition (H1) in Lemma 3.1 is verified successfully.

As a result, by the aid of Lemma 3.1, we illustrate that there exists a unique ergodic stationary distribution. The proof is finished.

4 The extinction and persistence of system (1.2)

For convenience, the following notations and lemmas are introduced by us.

$\langle f(t)\rangle = \frac{1}{t}\int_0^t f(\varsigma)d\varsigma$, *herein* $f(t)$ *is an integral function on* $[0,+\infty)$.

Lemma 4.1*(Strong law of large number)(see [22]). Let* $M=\{M\}_{t\geq 0}$ *be a real valued continuous local martingale which disappear at* $t=0$. *Then*

$$\lim_{t\to\infty}\langle M,M\rangle_t = \infty \quad a.s. \Rightarrow \lim_{t\to\infty}\frac{M_t}{\langle M,M\rangle_t}=0 \quad a.s.$$

also

$$\limsup_{t\to\infty}\frac{\langle M,M\rangle_t}{t}<\infty \quad a.s. \Rightarrow \lim_{t\to\infty}\frac{M_t}{t}=0 \quad a.s.$$

Lemma 4.2*(see [22]). For linear differential equation*

$$dx(t)=(F(t)x(t)+f(t))dt+\sum_{k=1}^{m}(G_k(t)x(t)+g_k(t))dB_k(t), \qquad (4.1)$$

The corresponding homogeneous equation is

$$dx(t)=F(t)x(t)dt+\sum_{k=1}^{m}G_k(t)x(t)dB_k(t). \qquad (4.2)$$

The fundamental solution matrix of equation (4.2) is given by

$$\Phi(t)=\exp[\int_{t_0}^{t}(F(s)-\frac{1}{2}\sum_{k=1}^{m}G_k^2(s))ds+\sum_{k=1}^{m}\int_{t_0}^{t}G_k(s)dB_k(s)].$$

We then obtain the explicit solution of equation (4.1)

$$x(t)=\Phi(t)[x_0+\int_{t_0}^{t}\Phi^{-1}(s)(f(s)-\sum_{k=1}^{m}G_k(s)g_k(s))ds+\sum_{k=1}^{m}\int_{t_0}^{t}\Phi^{-1}(s)g_k(s)dB_k(s)].$$

Lemma 4.3*(see [22]). Let* $\{A_t\}_{t\geq 0}$ *and* $\{U_t\}_{t\geq 0}$ *be two continuous increasing process with* $A(0)=U(0)=0$ *a.s. . Let* $\{M_t\}_{t\geq 0}$ *be a real valued continuous local martingale with* $M(0)=0$. *Let* ξ *be nonnegative* F_{0^-} *measurable random variable. Define*

$X_t=\xi+A_t-U_t+M_t$, *for* $t\geq 0$.

If X_t *is nonnegative, then*

$$\{\lim_{t\to\infty}A_t<\infty\}\subset\{\lim_{t\to\infty}X_t \text{ exists and is finite}\}\bigcap\{\lim_{t\to\infty}U_t<\infty\} \quad a.s.$$

where $B\subset D$ *a.s. means* $P(B\bigcap D^c)=0$. *In particular,if* $\limsup_{t\to\infty}A_t<\infty$ *a.s.,then for almost all* $\omega\in\Omega$, *we can get*

$\lim_{t\to\infty}X_t(\omega)$ *exists and is finite,and* $\lim_{t\to\infty}U_t<\infty$

Lemma 4.4 *Assume that* $(S(t),H(t),I(t),R(t))$ *is the solution of the system (1.2) possessing the initial value* $(S(0),H(0),I(0),R(0))\in R_+^4$, *then we get*

$$\limsup_{t\to\infty}(S(t)+H(t)+I(t)+R(t))<\infty \quad a.s.$$

as well as

$$\lim_{t\to\infty}\frac{S(t)}{t}=0,\lim_{t\to\infty}\frac{H(t)}{t}=0,\lim_{t\to\infty}\frac{I(t)}{t}=0,\lim_{t\to\infty}\frac{R(t)}{t}=0, a.s. \qquad (4.3)$$

$$\lim_{t\to\infty}\frac{\ln S(t)}{t}=0,\lim_{t\to\infty}\frac{\ln H(t)}{t}=0,\lim_{t\to\infty}\frac{\ln I(t)}{t}=0,\lim_{t\to\infty}\frac{\ln R(t)}{t}=0, \ a.s. \qquad (4.4)$$

And

$$\lim_{t\to\infty}\frac{\int_0^t S(\varsigma)dB_1(\varsigma)}{t}=0,\lim_{t\to\infty}\frac{\int_0^t H(\varsigma)dB_2(\varsigma)}{t}=0,$$
$$\lim_{t\to\infty}\frac{\int_0^t I(\varsigma)dB_3(\varsigma)}{t}=0,\lim_{t\to\infty}\frac{\int_0^t R(\varsigma)dB_4(\varsigma)}{t}=0.\quad a.s. \qquad (4.5)$$

Proof. *Adding the two sides of the four equations of the system (1.2) respectively, we can see that*

$$d(S+H+I+R)=[m-\mu(S+H+I+R)]dt+\sigma_1 SdB_1(t)+\sigma_2 HdB_2(t)+\sigma_3 IdB_3(t)+\sigma_4 RdB_4(t). \qquad (4.6)$$

By calculating equation (4.6) according to Lemma 4.2, we can obtain

$$S(t)+H(t)+I(t)+R(t)=\frac{m}{\mu}+(S(0)+H(0)+I(0)+R(0)-\frac{m}{\mu})e^{-\mu t}+W(t). \qquad (4.7)$$

where

$$W(t)=\sigma_1\int_0^t e^{-\mu(t-\varsigma)}S(\varsigma)dB_1(\varsigma)+\sigma_2\int_0^t e^{-\mu(t-\varsigma)}H(\varsigma)dB_2(\varsigma)$$
$$+\sigma_3\int_0^t e^{-\mu(t-\varsigma)}I(\varsigma)dB_3(\varsigma)+\sigma_4\int_0^t e^{-\mu(t-\varsigma)}R(\varsigma)dB_4(\varsigma).$$

It is clear that $W(t)$ *is a real continuous local martingale possessing the property of* $W(0)=0$.

Let

$$X(t)=X(0)+Y(t)-Z(t)+W(t).$$

at which

$$X(0)=\frac{m}{\mu}[S(0)+H(0)+I(0)+R(0)],Y(t)=\frac{m}{\mu}(1-e^{-\mu t}),$$
$$Z(t)=[S(0)+H(0)+I(0)+R(0)](\frac{m}{\mu}-e^{-\mu t}).$$

According to (4.7), we can see that

$$S(t)+H(t)+I(t)+R(t)=X(t)\quad a.s.\quad t\geq 0.$$

From the form of $Y(t)$ *and* $Z(t)$, *it is not hard for us to see that* $Y(t)$ *and* $Z(t)$ *are continuous increasing process and have the property of* $Y(0)=Z(0)=0$ *for all* $t\geq 0$. *Therefore by virtue of Lemma 4.3 that is Theorem 3.9 in the literature [22], we can obtain that* $\lim_{t\to\infty}X(t)<\infty$ *a.s..*

That is,

$$\limsup_{t\to\infty}(S(t)+H(t)+I(t)+R(t))<\infty \quad a.s.$$

Let

$$N_1(t)=\int_0^t S(\varsigma)d(\varsigma),N_2(t)=\int_0^t H(\varsigma)d(\varsigma),N_3(t)=\int_0^t I(\varsigma)d(\varsigma),N_4(t)=\int_0^t R(\varsigma)d(\varsigma).$$

So we can see that

$$\limsup_{t\to\infty}\frac{\langle N_1,N_1\rangle_t}{t}\leq\sup_{t\geq 0}S^2(t)<\infty.$$

Therefore, with the help of Lemma 4.1, we see

$$\lim_{t\to\infty}\frac{\int_0^t S(\varsigma)dB_1(\varsigma)}{t}=0\ .\ a.s.$$

In a similar method, we can get

$$\lim_{t\to\infty}\frac{\int_0^t H(\varsigma)dB_2(\varsigma)}{t}=0,\lim_{t\to\infty}\frac{\int_0^t I(\varsigma)dB_3(\varsigma)}{t}=0,\lim_{t\to\infty}\frac{\int_0^t R(\varsigma)dB_4(\varsigma)}{t}=0\ .\ a.s.$$

Furthermore, because $S(t),H(t),I(t),R(t)$ *are bounded and positive, we draw the conclusion*

$$\lim_{t\to\infty}\frac{S(t)}{t}=0,\lim_{t\to\infty}\frac{H(t)}{t}=0,\lim_{t\to\infty}\frac{I(t)}{t}=0,\lim_{t\to\infty}\frac{R(t)}{t}=0\ ,a.s.$$

and

$$\lim_{t\to\infty}\frac{\ln S(t)}{t}=0,\lim_{t\to\infty}\frac{\ln H(t)}{t}=0,\lim_{t\to\infty}\frac{\ln I(t)}{t}=0,\lim_{t\to\infty}\frac{\ln R(t)}{t}=0\ ,a.s.$$

This accomplishes the proof of Lemma 4.4.

4.1 Extinction

In this subsection, we give the condition for the extinction of the rumors in the sense of mean.

Theorem 4.1 *Assume that* $(S(t),H(t),I(t),R(t))$ *is the solution of the system (1.2) possessing the initial value* $(S(0),H(0),I(0),R(0))\in R_+^4$. *If*

$$\bar{R}_0=\frac{6(m\alpha-\mu^2)}{\mu(\sigma_2^2\wedge\sigma_3^2\wedge\sigma_4^2)}<1,$$

then

$$\limsup_{t\to\infty}\frac{\ln(H(t)+I(t)+R(t))}{t}\le\frac{m\alpha}{\mu}-\mu-\frac{\sigma_2^2\wedge\sigma_3^2\wedge\sigma_4^2}{6}=\frac{\sigma_2^2\wedge\sigma_3^2\wedge\sigma_4^2}{6}(\bar{R}_0-1)<0.$$

as well as

$$\lim_{t\to\infty}\langle S(t)\rangle=\frac{m}{\mu}\ .a.s.$$

Proof. *Integrating the first equation of the system (1.2) from 0 to* t *and dividing by* t, *then we can get*

$$\frac{S(t)-S(0)}{t}=m-\alpha\langle S(t)I(t)\rangle-\mu\langle S(t)\rangle+\frac{\sigma_1}{t}\int_0^t S(\varsigma)dB_1(\varsigma)\qquad(4.8)$$

By calculating (4.8), then we have

$$\mu\langle S(t)\rangle=m-\alpha\langle S(t)I(t)\rangle-\frac{S(t)-S(0)}{t}+\frac{\sigma_1}{t}\int_0^t S(\varsigma)dB_1(\varsigma).\qquad(4.9)$$

Taking the limit of the sides of (4.9), then we see that

$$\begin{aligned}\lim_{t\to\infty}\langle S(t)\rangle&=\frac{1}{\mu}\lim_{t\to\infty}[m-\alpha\langle S(t)I(t)\rangle-\frac{S(t)-S(0)}{t}+\frac{\sigma_1}{t}\int_0^t S(\varsigma)dB_1(\varsigma)]\\&\le\frac{1}{\mu}\lim_{t\to\infty}[m+\frac{\sigma_1}{t}\int_0^t S(\varsigma)dB_1(\varsigma)].\end{aligned}\qquad(4.10)$$

According to (4.5) in Lemma 4.4, we have the conclusion

$$\lim_{t\to\infty}\langle S(t)\rangle\le\frac{m}{\mu}.\qquad(4.11)$$

In the following, let $V_0(t)=\ln[H(t)+T(t)+R(t)]$, *applying the Itô formula to* $V_0(t)$, *then we have*

$$\begin{aligned}dV_0(t)=&[\frac{\alpha SI-\mu(H+I+R)}{H+I+R}-\frac{1}{2(H+I+R)^2}(\sigma_2^2H^2+\sigma_3^2I^2+\sigma_4^2R^2)]dt\\&+\frac{\sigma_2H}{H+I+R}dB_2(t)+\frac{\sigma_3I}{H+I+R}dB_3(t)+\frac{\sigma_4R}{H+I+R}dB_4(t)\\\le&[\alpha S-\mu-\frac{\sigma_2^2H^2+\sigma_3^2I^2+\sigma_4^2R^2}{2(H+I+R)^2}]dt+\frac{\sigma_2H}{H+I+R}dB_2(t)+\frac{\sigma_3I}{H+I+R}dB_3(t)+\frac{\sigma_4R}{H+I+R}dB_4(t)\\\le&(\alpha S-\mu-\frac{\sigma_2^2\wedge\sigma_3^2\wedge\sigma_4^2}{6})dt+\frac{\sigma_2H}{H+I+R}dB_2(t)+\frac{\sigma_3I}{H+I+R}dB_3(t)+\frac{\sigma_4R}{H+I+R}dB_4(t).\end{aligned}\qquad(4.12)$$

For the last inequality of (4.12), we use the inequality $(H+I+R)^2\le3(H^2+I^2+R^2)$. *Integrating (4.12) from 0 to* t *and dividing by* t, *then we can obtain*

$$\frac{V_0(t)-V_0(0)}{t} \le \alpha\langle S(t)\rangle - \mu - \frac{\sigma_2^2\wedge\sigma_3^2\wedge\sigma_4^2}{6} + \frac{\sigma_2}{t}\int_0^t \frac{H(\varsigma)}{H(\varsigma)+I(\varsigma)+R(\varsigma)}dB_2(t)$$
$$+\frac{\sigma_3}{t}\int_0^t \frac{I(\varsigma)}{H(\varsigma)+I(\varsigma)+R(\varsigma)}dB_3(t)+\frac{\sigma_4}{t}\int_0^t \frac{R(\varsigma)}{H(\varsigma)+I(\varsigma)+R(\varsigma)}dB_4(t). \quad (4.13)$$

Next taking the limit superior both sides of (4.13) and by virtue of (4.11) and Lemma 4.1 as well as (4.4) in Lemma 4.4, in addition, according to the assumption $\bar{R}_0<1$, *therefore we can attain*

$$\limsup_{t\to\infty}\frac{\ln(H(t)+I(t)+R(t))}{t} \le \frac{m\alpha}{\mu}-\mu-\frac{\sigma_2^2\wedge\sigma_3^2\wedge\sigma_4^2}{6}=\frac{\sigma_2^2\wedge\sigma_3^2\wedge\sigma_4^2}{6}(\bar{R}_0-1)<0.$$

which means that

$$\lim_{t\to\infty}H(t)=0,\lim_{t\to\infty}I(t)=0,\lim_{t\to\infty}R(t)=0.$$

Finally, from (4.10) and according to $\lim_{t\to\infty}I(t)=0$, *we draw the conclusion*

$$\lim_{t\to\infty}\langle S(t)\rangle=\frac{m}{\mu}. \text{ a.s.}$$

The proof is finished.

4.2 Persistence in mean

In this subsection, we will give the condition for the persistence in the sense of the rumors by calculating in detail. First of all, we introduce the definition of persistence in mean.

Definition 4.2 *The system (1.2) is said to be persistent in mean if* $\lim_{t\to\infty}\frac{1}{t}\int_0^t I(\varsigma)d\varsigma>0$. *a.s.*

Theorem 4.2 *For given initial value* $(S(0),H(0),I(0),R(0))\in\Gamma$, *if*

$$R_0^S := \frac{\beta_2\alpha m}{(\mu+\frac{1}{2}\sigma_1^2)(\delta+\mu+\frac{1}{2}\sigma_3^2)}+\frac{\alpha\beta_1 m\gamma\eta}{(\mu+\frac{1}{2}\sigma_1^2)(\eta+\mu+\frac{1}{2}\sigma_2^2)(\delta+\mu+\frac{1}{2}\sigma_3^2)}>1,$$

then

$$\liminf_{t\to\infty}\langle I(t)\rangle \ge \frac{(\delta+\mu+\frac{1}{2}\sigma_3^2)(R_0^S-1)}{(a_1+b_1)\alpha}. \text{ a.s.}$$

where

$$a_1=\frac{\beta_2\alpha m}{(\mu+\frac{1}{2}\sigma_1^2)^2}, b_1=\frac{\alpha\beta_1 m\gamma\eta}{(\mu+\frac{1}{2}\sigma_1^2)^2(\eta+\mu+\frac{1}{2}\sigma_2^2)}.$$

In other words, the rumors will prevail if $R_0^S>1$.

Proof. *Making use of the same function as the proof of Theorem 3.1, let*

$$V_1=-\ln I-(a_1+b_1)\ln S-c_1\ln H,$$

where a_1,b_1,c_1 *are the same form as the proof of Theorem 3.1. Applying the Itô formula to* V_1, *we can attain that*

$$dV_1=LV_1dt-\sigma_3 dB_3(t)-(a_1+b_1)\sigma_1 dB_1(t)-c_1\sigma_2 dB_2(t) \quad (4.14)$$

From the proof of Theorem 3.1, we can obtain

$$LV_1 \le -\frac{\beta_2\alpha m}{\mu+\frac{1}{2}\sigma_1^2}-\frac{\alpha\beta_1 m\gamma\eta}{(\mu+\frac{1}{2}\sigma_1^2)(\eta+\mu+\frac{1}{2}\sigma_2^2)}+\delta+\mu+\frac{1}{2}\sigma_3^2+(a_1+b_1)\alpha I \quad (4.15)$$
$$=-(\delta+\mu+\frac{1}{2}\sigma_3^2)(R_0^s-1)+(a_1+b_1)\alpha I.$$

In the following, on the basis of (4.15), we take the integration both sides of (4.14) from 0 to t *and dividing by* t, *then we can get*

$$\frac{V_1(S(t),H(t),I(t),R(t))-V_1(S(0),H(0),I(0),R(0))}{t}$$
$$\leq -(\delta+\mu+\frac{1}{2}\sigma_3^2)(R_0^s-1)+(a_1+b_1)\alpha\langle I(t)\rangle-\frac{\phi(t)}{t}, \quad (4.16)$$

in which

$$\phi(t)=\sigma_3 dB_3(t)+(a_1+b_1)\sigma_1 dB_1(t)+c_1\sigma_2 dB_2(t).$$

According to Lemma 4.1, we can see that

$$\limsup_{t\to\infty}\frac{\phi(t)}{t}=0 \ .a.s.$$

Then making use of (4.4),(4.16) and taking advantage of the assumption that $R_0^s>0$. *So by taking the limit inferior of both side of (4.16), we have*

$$\liminf_{t\to\infty}\langle I(t)\rangle\geq\frac{(\delta+\mu+\frac{1}{2}\sigma_3^2)(R_0^s-1)}{(a_1+b_1)\alpha} \ .a.s.$$

The proof is completed.

5 Numerical simulations

In this section, we will carry out some numerical simulations to justify the theoretical results attained in this paper.

(1) We choose the parameters as follows

$$m=1,\alpha=0.4,\mu=0.6,\beta_1=0.3,\beta_2=0.2,\eta=0.2,\delta=0.1,\gamma=0.1,$$

as well as

$$\sigma_1^2=0.5,\sigma_2^2=0.5,\sigma_3^2=0.6,\sigma_4^2=0.7.$$

where the value of parameters $m,\beta_1,\beta_2,\eta,\delta,\gamma$ *are from the literature [10] and the rest of the parameters are assumption. In addition, we make an assumption that the initial values of the system (1.2) are*

$S(0)=2.0,H(0)=0.3,I(0)=0.5,R(0)=0.1$. *Then,*

$$R_0=\frac{\alpha m[\beta_2(\mu+\eta)+\beta_1\gamma\eta]}{\mu(\mu+\delta)(\mu+\eta)}\approx 0.1976<1.$$

So according to the theory in the literature [10], we know that the rumor-free equilibrium $E_0(\frac{m}{\mu},0,0)=(1.67,0,0,0)$ *is globally asymptotically stable. In addition, By computing,*

$$\bar{R}_0=\frac{6(m\alpha-\mu^2)}{\mu(\sigma_2^2\wedge\sigma_3^2\wedge\sigma_4^2)}=0.8<1.$$

So, it can be showed from Theorem 4.1 that rumor dies out, that is

$$\lim_{t\to\infty}H(t)=\lim_{t\to\infty}I(t)=\lim_{t\to\infty}R(t)=0.$$

Fig.1 further confirms these results.

(2) We choose the parameters as follows

$$m=5,\alpha=0.3,\mu=0.25,\beta_1=0.2,\beta_2=0.4,\eta=0.3,\delta=0.2,\gamma=0.3,$$

and

$$\sigma_1^2=0.2,\sigma_2^2=0.2,\sigma_3^2=0.2,\sigma_4^2=0.4,$$

where the value of parameters $\mu,\beta_1,\beta_2,\eta,\delta,\gamma$ *are from the literature [10] and the rest of the parameters are assumption. In addition, we make an assumption that the initial values of the system (1.2) are*

$$S(0)=3.0,H(0)=1.0,I(0)=1.0,R(0)=4.0.$$

On the basis of the condition above, we can verify $R_0 = \frac{\alpha m[\beta_2(\mu+\eta)+\beta_1\gamma\eta]}{\mu(\mu+\delta)(\mu+\eta)} \approx 5.7697 > 1$. *Then from [10], we have the conclusion that* $E_*(3.4664, 1.5031, 3.9748, 10.0458)$ *is globally asymptotically stable. Furthermore, we also can verify that*

$$R_0^S := \frac{\beta_2\alpha m}{(\mu+\frac{1}{2}\sigma_1^2)(\delta+\mu+\frac{1}{2}\sigma_3^2)} + \frac{\alpha\beta_1 m\gamma\eta}{(\mu+\frac{1}{2}\sigma_1^2)(\eta+\mu+\frac{1}{2}\sigma_2^2)(\delta+\mu+\frac{1}{2}\sigma_3^2)} \approx 3.3327 > 1.$$

So, it can be illustrated from Theorem 3.1 and Theorem 4.2 that there is a unique stationary distribution and the rumor is persistent. Fig. 2 and Fig. 3 validates this conclusion.

(3) *On the basis of the case (2), we assume that* $\sigma_1^2 = 0.8, \sigma_2^2 = 1.2, \sigma_3^2 = 1.2, \sigma_4^2 = 1$, *in the meanwhile, we also leave the rest of the parameters and the initial value of the system (1.2) in example 5.2 unchanged. then we can verify*

$$R_0^S := \frac{\beta_2\alpha m}{(\mu+\frac{1}{2}\sigma_1^2)(\delta+\mu+\frac{1}{2}\sigma_3^2)} + \frac{\alpha\beta_1 m\gamma\eta}{(\mu+\frac{1}{2}\sigma_1^2)(\eta+\mu+\frac{1}{2}\sigma_2^2)(\delta+\mu+\frac{1}{2}\sigma_3^2)} \approx 0.9135 < 1.$$

Therefore, this condition does not satisfy Theorem 4.2, the result can be seen in Fig.4. by Fig.4, we can draw the conclusion that the larger intensity of white noise set may be help to the elimination of the rumor.

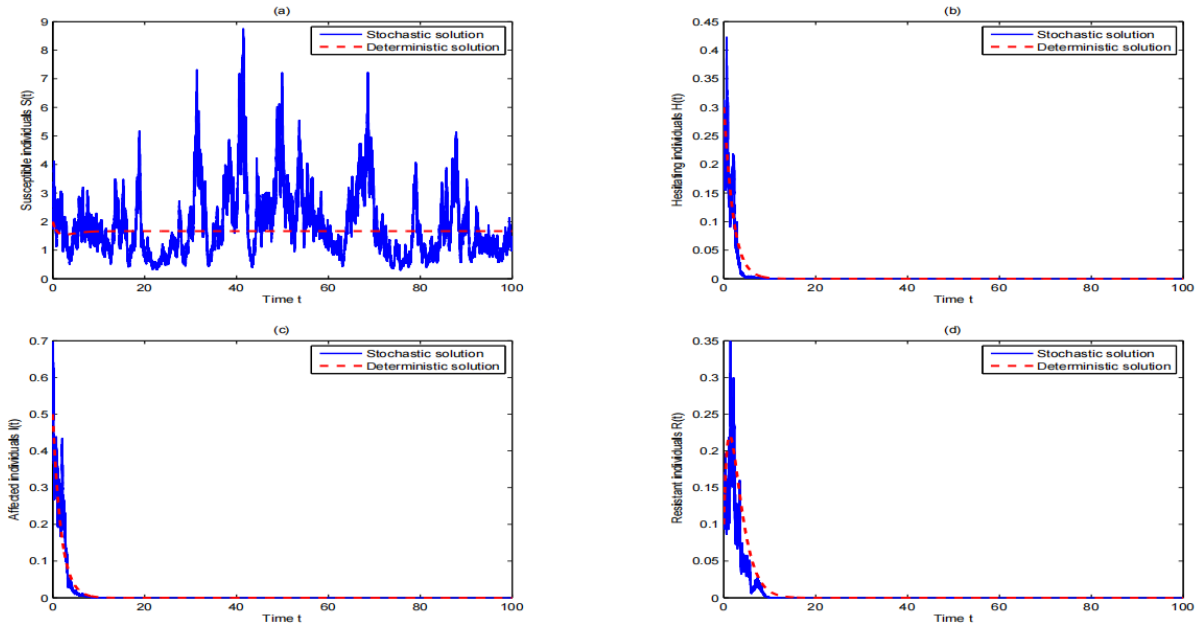

Figure 1: Extinction: stochastic and deterministic cases. (a) Sample paths of $S(t)$*; (b) Sample paths of* $H(t)$*; (c) Sample paths of* $I(t)$*; (d) Sample paths of* $R(t)$

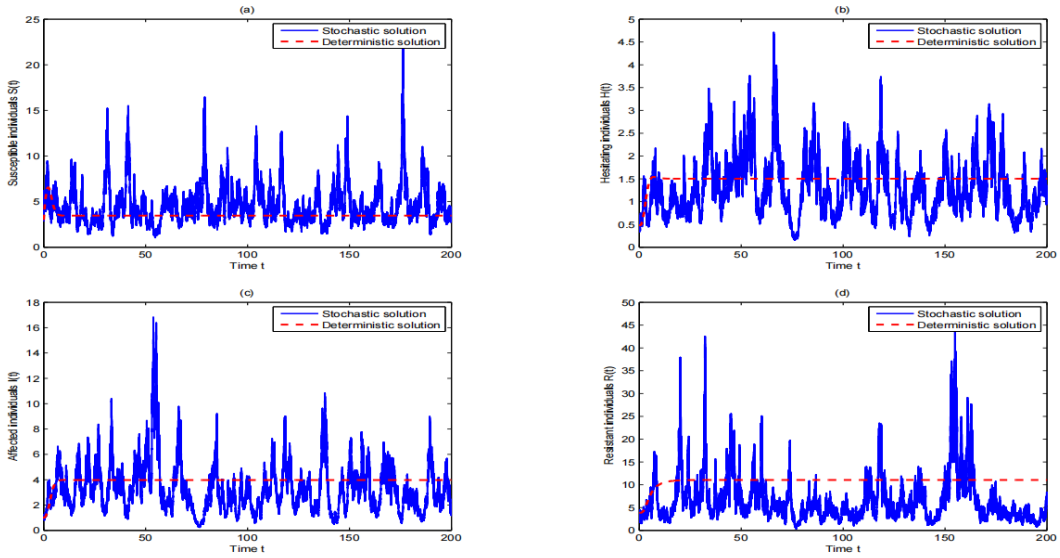

Figure 2: Persistence in mean: stochastic and deterministic cases. (a) Sample paths of $S(t)$*; (b) Sample paths of* $H(t)$*; (c) Sample paths of* $I(t)$*; (d) Sample paths of* $R(t)$

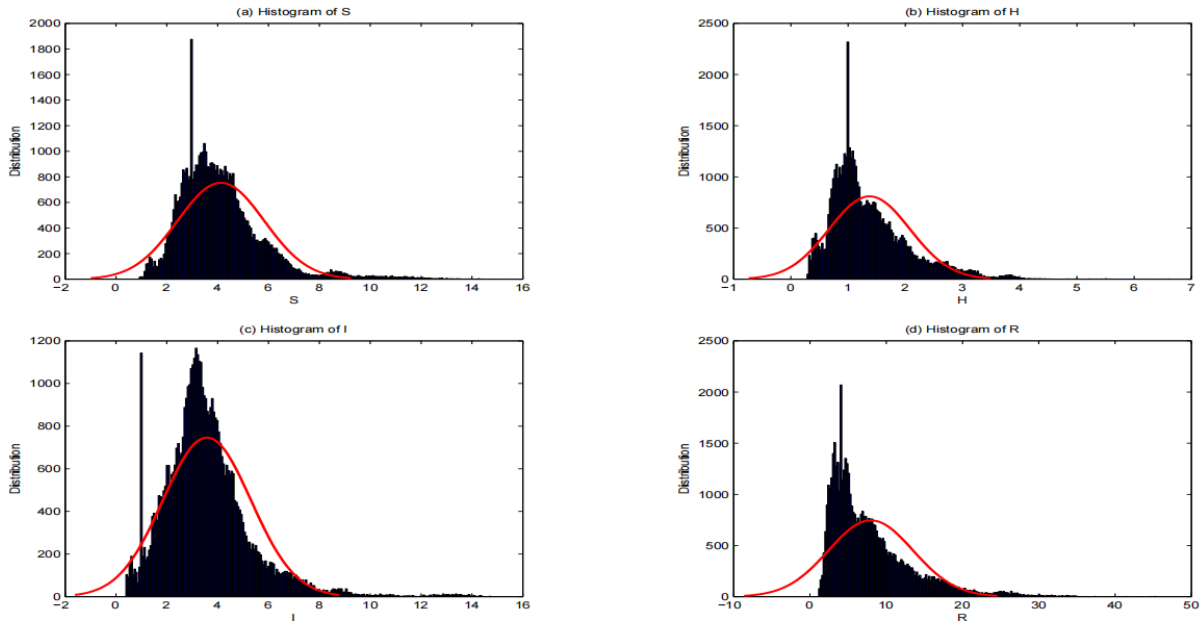

Figure 3: Distributions of $S(t), H(t), I(t), R(t)$ *(a) Sample paths of* $S(t)$*; (b) Sample paths of* $H(t)$*; (c) Sample paths of* $I(t)$*; (d) Sample paths of* $R(t)$

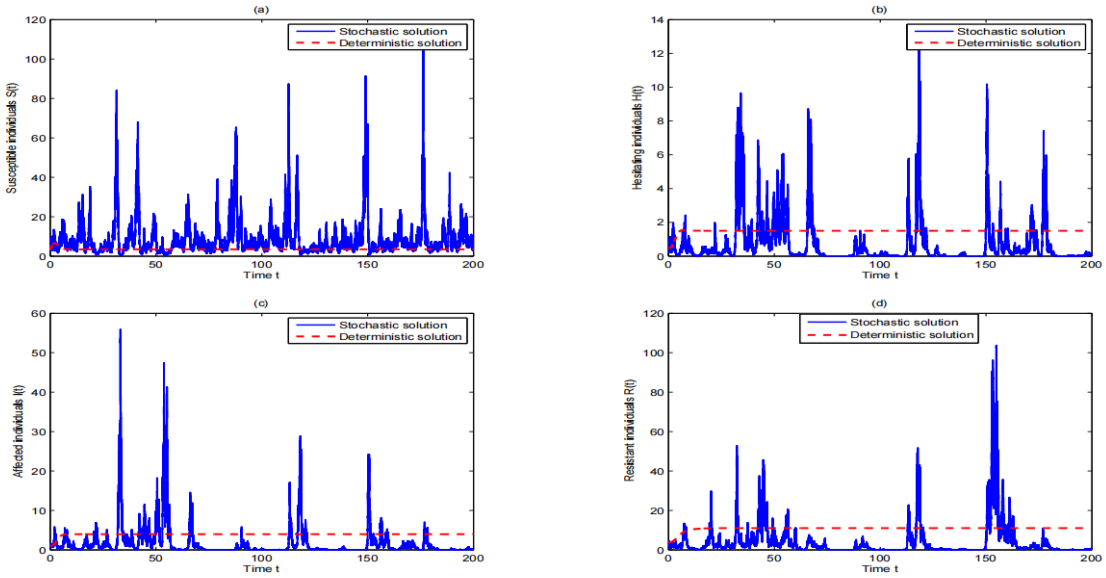

Figure 4: Rumors die out in stochastic model (1.2) and persist in deterministic model (1.1). (a) Sample paths of $S(t)$; (b) Sample paths of $H(t)$; (c) Sample paths of $I(t)$; (d) Sample paths of $R(t)$

6 Conclusions

Here we propose and study a stochastic rumor spreading model with the different attitudes towards rumors, The model is an extension of the model in literature [10]. At first, we illustrate that there is a unique global positive solution for system (1.2) with the initial value. Then, we present the conditions of the existence of ergodic stationary distribution of system (1.2). Next we also obtain the conditions of the extinction and persistence in the mean of the rumors of the system (1.2). Finally, we put into force the numerical simulation in order to make our results more convinced. Our simulations indicate that the small intensity of white noise set can make rumor persistent, while the larger one may be help to the elimination of the rumor. We have drawn the conclusion that if we want to control the spread of rumor, then we have to increase the intensity of random interference. In other word, we should try to lead people to believe in science, not in rumors. Compared with literature [19–21], they have not studied the existence and uniqueness of the stationary distribution of the system. The model that we build is more realistic, our research content is richer. However, our research on this model is not thorough and perfect. In the next step, we will consider to introduce time delay into this model to study its dynamic properties.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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Medical sciences

THE PECULIARITIES OF PERINEURIAL BARRIER. ANIMAL MODEL OF STUDY

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Introduction: *Extraceptive, intraceptive, proprioceptive type sensory information translated to the central nervous system by primary sensory neurons that placed in dorsal root ganglions (DRG) – forming the initial part of spinal peripheral nerve.*

The primary sensory neurons with coating satellite glial cells , as well as myelinated and unmyelinated nerve fibers arised from them, accompanied vascular network surrounded by connective tissue. The connective tissue of DRG subdivided into capsule and endoganglionar connective tissue elements. The endoganglionar connective tissue elements, that directly surrounded nerve and vascular elements within organ. Capsule of DRG closed all components of DRG and izolated them from surrounding structural elements, as well as performed protective function for primary sensory neurons.

Aim*: The purpose of research work was to study the histological and ultrastructural peculiarities of connective tissue elements surrounding and within dorsal root ganglia.*

Materials and Methods: *The object of the scientific work were dorsal root ganglia obtained from 20 white rats weighting 220 - 240 grams. The animals secured and fed in standard laboratory at specific pathogen-free conditions of Scientific Research Center of the Azerbaijan Medical University. Experimental rats under ketamine anesthesia decapitated, obtained dorsal root ganglia from lumbar level of spinal cord of rats, then specimen fixated, dehydrated, prepared Araldit-Epon blocks. Gained from blocks on ultratomes LKB-III, Leica EM UC7 semithin sections in thickness 1-2μm were stained with methylene blue, azure II and basic fuchsine. After investigation under Latimet (Leitz) microscope essential parts of images were taken with Pixera (USA) digital camera with different objectives. Ultrathin sections from same blocks first painted with 2% uranyl acetate solution, then in 0.6% lead citrate made in NaOH 0.1N solution. After examination of ultrathin sections under 80-120 kV in transmission electron microscope JEM-1400 were received the electronograms.*

Results and Discussion: *The obtained data show that the capsule of the DRG is extension of spinal meningeal layer and this layer overtakes up to DRG and created its capsule. On light microscopic examination observed the outer part of capsule composed of dense irregular collagenous connective tissue elements with many number adipocytes, blood vessels with different size and types (arterial and venous vessels). The outer layer more thicker and lightly stained. However, inner layer of capsule is separated from outer layer by appearing in the form of thin strip stained in dark color in histological slide. On electronograms sharply detected thick outer layer corresponding to epineurium of peripheral nerve that composing fibroblast, elastic and thick bundle of collagen fibers, the latter belong to type I collagen fibrils, which are resistant to mechanical effects. The inner layer of capsule (corresponding to perineurium of peripheral nerve) comprising from flattened perineurial cells that closely spaced to each other and created the sheath. The collagen fibers, producing by perineurial cells situated between these cells and its processes, belong to type III collagen fibers, the latter also named reticular fibers.*

The ultrastructural investigation of the perineurium reveals that it consists of in 6-8 number layer of flattened perineurial cells, that cells encircled on both sides by basal lamina. In addition, the processes of perineurial cells also covered by basal lamina. However, there is also observed the elastic fibers among the perineurial cells in size 2.3μm. Central regions of elastic fibers composed of elastin, which has an amorphous structure and is distinguished by its osmiophobia from surrounding structures. The peripherally in the form of stripes along their entire perimeter are present cross-sections of microfibrils, which form the core of elastic fibers. Under stereometric grids, it was observed that approximately 60% of the total areas of the elastic fibers presenting between perineurial cells belong to microfibrils of the fibril.

The perineurial cells composing the inner layer of capsule of the DRG, joined with each other by tight junction in same layer of cells, as well as adhesive and gap junction in the adjacent layer of cells. Due to peculiarities of components of this layer in different pathological situation it formed barrier and protected the organ.

Conclusion: *Considering above data, it can be noted that the inner layer of the capsule of the dorsal root ganglia played the significant role in creating physical barrier and maintained integrity, stability of peripheral nerve. as biological barrier. This barrier under effect of different pathological and physiologic condition, limits the entering of some active substances, infections, toxins, some ions and blood-borne cells into the nerve bundles.*

OPTIONS FOR APPLYING THE INHALATION METHOD IN COMBINATION WITH DRUG THERAPY FOR LARINGOPHARINGEAL REFLUX

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Abstract

Laryngopharyngeal reflux (LPR) is the reflux of gastric contents (acid and enzymes such as pepsin) into the larynx, leading to hoarseness, difficulty swallowing, coughing, and a feeling of mucus in the laryngopharynx. There are relatively limited data on the prevalence of LPR: approximately 30% of healthy people may have episodes of reflux on 24-hour pH measurements or show characteristic changes in the larynx. LPR can directly or indirectly cause laryngeal symptoms. The direct mechanism involves irritation of the mucous membrane of the larynx with caustic substances - refluxates (acid, pepsin). The indirect mechanism involves irritation of the esophagus, leading to laryngeal reflexes and symptoms. Helicobacter pylori infection may also contribute. The prevalence of H. pylori among patients with LPR is about 44%.

This article presents the results of diagnosis and treatment of patients with LPR in the ENT clinic of the Tajik State Medical University named after Abuali ibni Sino. A clear assessment of the effectiveness of the inhalation method in combination with drug therapy for patients with laryngopharyngeal reflux is given.

Keywords: *laryngopharyngeal reflux, dysphonia, hyperemia and edema of the laryngeal mucosa, inhalation and drug therapy.*

Introduction. *Laryngopharyngeal reflux (LPR) is the reflux of gastric contents (acid and enzymes such as pepsin) into the larynx, leading to a hoarse voice, difficulty swallowing, coughing, and a feeling of mucus in the laryngopharynx. There are relatively limited data on the prevalence of LPR: approximately 30% of healthy people may have episodes of reflux on 24-hour pH measurements or show characteristic changes in the larynx. LPR can directly or indirectly cause laryngeal symptoms. The direct mechanism involves irritation of the mucous membrane of the larynx with caustic substances - refluxates (acid, pepsin). The indirect mechanism involves irritation of the esophagus, which leads to laryngeal reflexes and symptoms. Helicobacter pylori infection may also contribute. The prevalence of H. pylori among patients with LPR is about 44% [1, 3, 4].*

To form LPR, much less acid exposure is required than with gastroesophageal reflux. There are significant differences between the mucous membrane of the esophagus and larynx. The upper limit of normal for acid reflux into the esophagus is considered to be up to 50 episodes per day, while 4 episodes of reflux into the larynx is no longer considered normal. In the larynx, unlike the esophagus, which eliminates acid through peristalsis, refluxate persists much longer, causing additional irritation. The epithelium of the larynx is thin and poorly adapted to combat caustic chemical damage from the same pepsin and acid [4, 5].

There is considerable controversy regarding the appropriate way to diagnose LPR. Most patients are diagnosed clinically, based on symptoms associated with LPR.

Laryngoscopy reveals swelling and hyperemia of the laryngeal mucosa of varying degrees. The weak correlation between these symptoms and endoscopic findings is a relative argument against the use of endoscopic diagnostic methods. The Reflux Symptom Score and Reflux Symptom Index are also suitable for both diagnosis and monitoring response to therapy [6-8].

When choosing a specific therapy, the authors recommend giving up smoking, alcohol, and eliminating foods and drinks containing caffeine, chocolate, and mint. Prohibited foods also include most fruits (especially citrus fruits), tomatoes, jams and jellies, barbecue sauces and most salad dressings, and spicy foods. Small meals are recommended. You should avoid exercise for at least two hours after eating, and refrain from eating or drinking three hours before bedtime. Drug therapy usually includes proton

pump inhibitors (PPIs), H2 blockers, and antacids. A PPI is recommended for six months for most patients with LPR. This figure is based on the results of endoscopic studies (this is the time needed to reduce laryngeal edema), as well as the high percentage of relapse in the case of a three-month course of therapy. Discontinuation of therapy should be carried out gradually [2, 9, 10].

***Purpose of the study**. Evaluation of the effectiveness of the inhalation method in combination with drug therapy for laryngopharyngeal reflux.*

***Materials and methods**. In the ENT clinic of the State Educational Institution "Avicenna Tajik Medical Univercity", we examined patients with complaints of hoarseness, a feeling of a lump in the throat, difficulty swallowing, cough, and a feeling of mucus in the laryngopharynx.*

During the examination, an endoscopic examination of the nasal cavity, nasopharynx and larynx was performed. To exclude other diseases that, in addition to LPR, can provoke these symptoms, additional studies were prescribed by a gastroenterologist as necessary. At the Institute of Gastroenterology, these patients underwent the necessary range of examinations (esovagoscopy, gastroduadenoscopy, etc.), including bacteriological examination to exclude H. Pylori infection.

As research material, we selected 18 patients with laryngopharyngeal reflux. Of these, there were 12 women and 6 men aged from 18 to 60 years. Depending on the complaints, the patients were divided into 2 groups.

1) 8 people complained of hoarseness and cough after eating;

2) 10 people had an obsessive cough, sore throat after eating and often noted heartburn.

In the vast majority of patients, the duration of the disease was more than 3-5 years. All patients underwent auditory voice assessment, indirect laryngoscopy and endolaryngoscopy.

***Research results**. In 8 patients, swelling of the mucous membrane of the arytenoid cartilages and interarytenoid space was revealed. Severe hyperemia of the interarytenoid region and thickening of the mucous membrane of the arytenoid cartilages were detected in 10 patients. All patients received complex treatment: inhalation therapy in combination with drug therapy, which was prescribed by a gastroenterologist. The inhalation mixture included: 0.9% sodium chlorine solution 5 ml, hydrocortisone emulsion 1 ml, decasan 1 ml, novocaine 0.5% -0.5 ml.*

As a result of the treatment in the 1st subgroup, all subjective and objective symptoms improved after the first course of treatment, and in the 2nd subgroup the course of treatment had to be repeated 2-3 times with a break of 2-3 weeks of inhalation and drug treatment.

***Conclusions**. A comparative analysis of the effectiveness of drug therapy in combination with nebulizer therapy revealed an improvement in clinical indicators, which is confirmed by an improvement in subjective indicators between subgroups 1 and 2. The key to successful therapy was considered to be joint examination and treatment with such specialists as a gastroenterologist and a psychiatrist.*

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ALTERATIONS IN BLOOD AND LYMPHATIC SYSTEMS IN DIABETES

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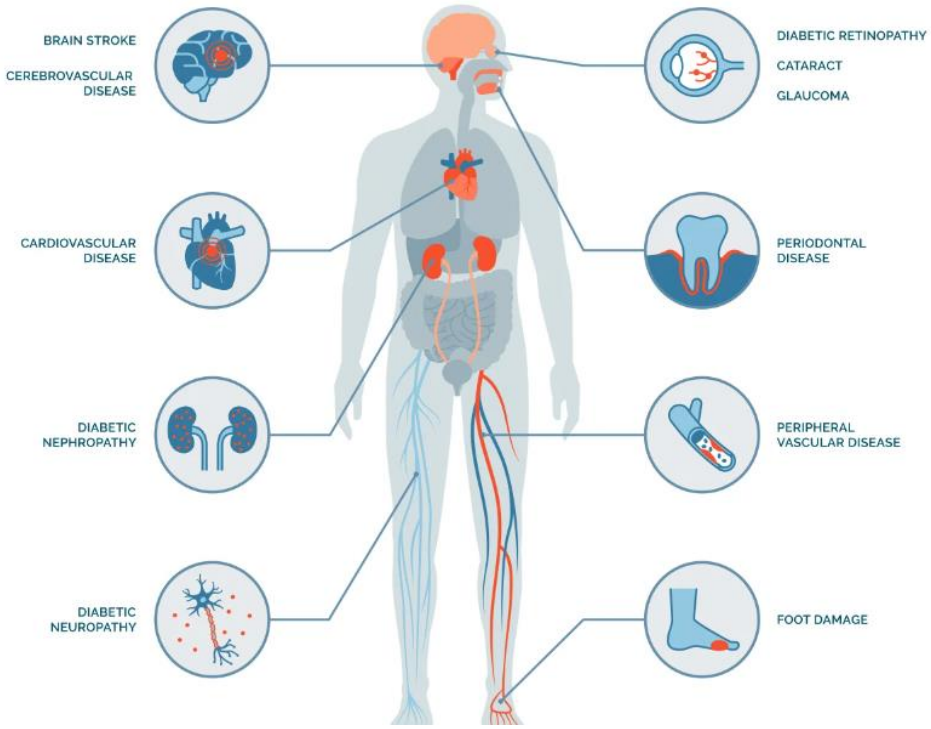
Abstract

Diabetes mellitus, a chronic metabolic disease characterized by elevated blood glucose levels, has systemic effects beyond glycemic control. Changes in the composition and function of blood and lymph play a key role in the complex network of physiological changes caused by them.

Introduction

Diabetes mellitus stands as a paramount non-infectious ailment of profound medical and socio-economic significance globally. Despite the implementation of diverse prevention and treatment strategies in the battle against this disease, its prevalence continues to surge at an alarming pace, evolving into an epidemic of substantial proportions. According to the International Diabetes Federation's data, the year 2021 witnessed 537 million documented cases of diabetes among individuals aged 20-79 worldwide. Projections reveal a staggering rise, with estimates soaring to 643 million by 2030 and a forecasted escalation to 783 million by 2045, reflecting an overall growth rate of 46%. This trajectory underscores the urgent need for intensified efforts in diabetes management and prevention strategies to mitigate the impending burden on healthcare systems and societies globally. [3]

Diabetes mellitus is a significant global medical problem with its rapid prevalence and increased morbidity and mortality. Classified within the spectrum of hereditary conditions, often polygenic in nature, and occasionally transmitted through autosomal-dominant inheritance, it manifests as a complex disorder disrupting various metabolic pathways. Managing this ailment necessitates a multifaceted approach, encompassing diverse interventions for effective correction and control.



The Effects of Diabetes on Your Body

Diabetes, whether type 1 or type 2, primarily impacts the body's ability to regulate blood sugar levels effectively. This dysfunction significantly affects various bodily functions, with the most pronounced impacts on the cardiovascular system, kidneys, eyes, and nerves. Prolonged high blood sugar levels can damage blood vessels, leading to cardiovascular complications such as heart disease, stroke, and peripheral vascular disease. Additionally, the kidneys may suffer from diabetic nephropathy, potentially progressing to kidney failure. Diabetes also poses risks to vision, causing diabetic retinopathy and increasing the likelihood of blindness. Furthermore, nerve damage, known as diabetic neuropathy,

can result in pain, tingling, or numbness in the extremities, affecting mobility and overall quality of life. Managing blood sugar levels through lifestyle changes and medication remains crucial in mitigating the adverse effects of diabetes on these vital bodily functions. Recently, it has been observed that diabetes causes certain changes in lymph and blood.

The intricate interplay between blood and lymph assumes heightened significance in diabetic pathophysiology, orchestrating a cascade of events that potentiate disease progression. Hyperglycemia-mediated endothelial dysfunction compromises microvascular integrity, facilitating the leakage of plasma proteins into the interstitium. Subsequently, increased interstitial oncotic pressure augments fluid influx into lymphatic capillaries, exacerbating lymphatic overload and impairing lymphatic drainage.

Furthermore, dysregulated lipid metabolism in diabetes precipitates the accumulation of lipoprotein-rich lymph, exacerbating the atherosclerotic burden and fostering plaque destabilization. This dyslipidemia-lymphatic axis fuels a vicious cycle of inflammation and oxidative stress, perpetuating endothelial dysfunction and vascular remodeling.

Contents of the study

In diabetes, blood composition undergoes profound shifts, primarily attributed to hyperglycemia-induced metabolic disturbances. Elevated blood glucose levels trigger glycation reactions, wherein glucose molecules irreversibly bind to proteins, forming advanced glycation end products (AGEs). AGE accumulation contributes to endothelial dysfunction, impairing vascular integrity and exacerbating diabetic complications.

Furthermore, dyslipidemia commonly accompanies diabetes, characterized by elevated triglycerides, decreased high-density lipoprotein (HDL) cholesterol, and altered low-density lipoprotein (LDL) particle size and density. These lipid abnormalities heighten atherosclerotic risk, fostering the development of cardiovascular diseases, the leading cause of mortality in diabetic individuals.

Additionally, diabetes predisposes individuals to thrombotic events through various mechanisms, including enhanced platelet aggregation, impaired fibrinolysis, and perturbed coagulation cascades. Consequently, diabetic patients exhibit heightened susceptibility to thromboembolic complications, accentuating the importance of stringent glycemic control and antithrombotic interventions. [2; 213]

While the lymphatic system's involvement in diabetes remains less explored compared to its circulatory counterpart, emerging evidence suggests its integral role in diabetic pathophysiology. Chronic hyperglycemia instigates oxidative stress and inflammation, eliciting lymphatic endothelial dysfunction and impairing lymphatic contractility. Consequently, lymphatic drainage becomes compromised, exacerbating tissue edema and fostering a pro-inflammatory milieu conducive to diabetic complications..

Moreover, diabetes-induced microvascular alterations extend to the lymphatic network, culminating in lymphatic capillary rarefaction and lymphangiogenesis dysregulation. Impaired lymphatic vessel density compromises interstitial fluid clearance, exacerbating tissue fibrosis and predisposing to diabetic lymphedema, a debilitating complication characterized by localized swelling and impaired wound healing. [1; 51]

When facing an increase in the effect of diabetes on the blood and lymphatic system, proactive measures become imperative to mitigate potential complications. Firstly, maintaining optimal blood sugar levels through proper diet, exercise, and medication adherence is paramount. Consistently high blood glucose levels can damage blood vessels and impair lymphatic function, exacerbating diabetic complications. Regular monitoring of blood glucose levels and adherence to a personalized management plan can help prevent further deterioration of these systems.

Secondly, adopting a healthy lifestyle is crucial in managing diabetes-related effects on the blood and lymphatic systems. Regular exercise not only helps control blood sugar levels but also promotes circulation and lymphatic drainage, reducing the risk of complications such as neuropathy and lymphedema. Additionally, a balanced diet rich in nutrients and low in processed sugars can support overall vascular and lymphatic health, minimizing the impact of diabetes on these systems.

Moreover, proactive screening and early intervention are essential components of managing diabetes-related complications. Regular check-ups with healthcare providers allow for early detection of issues affecting the blood and lymphatic systems, enabling timely interventions to prevent progression. This may include medications to control blood pressure and cholesterol levels, as well as interventions to manage complications such as diabetic retinopathy or peripheral neuropathy.

Lastly, education and support play a crucial role in empowering individuals with diabetes to take control of their health. Understanding the importance of blood sugar management and lifestyle modifications can motivate individuals to adhere to treatment plans and make healthier choices. Support groups and educational resources can provide valuable information and encouragement, fostering a

proactive approach to managing diabetes and its effects on the blood and lymphatic systems. By implementing these strategies, individuals can mitigate the impact of diabetes on their overall health and well-being.

Result

Understanding the intricate interplay between blood and lymph in diabetes holds profound therapeutic implications, underscoring the importance of multifaceted interventions targeting metabolic dysregulation, endothelial dysfunction, and lymphatic insufficiency. Pharmacotherapeutic agents modulating glucose and lipid metabolism, coupled with lifestyle modifications emphasizing dietary control and physical activity, form the cornerstone of diabetes management.

Moreover, emerging therapeutic modalities targeting lymphatic dysfunction, including pharmacological lymphangiogenic agents and lymphatic drainage therapies, offer promising avenues for ameliorating diabetic complications. However, further research elucidating the complex interplay between blood and lymph in diabetes is warranted to unravel novel therapeutic targets and refine existing management strategies, ultimately alleviating the substantial burden imposed by this pervasive metabolic disorder.

Managing diabetes effectively can significantly reduce or prevent its effects on the blood and lymphatic systems:

- *Keeping blood sugar levels within target ranges through medication, diet, and exercise is essential. Consistently high blood sugar levels can damage blood vessels and impair lymphatic function.*
- *A balanced diet rich in fruits, vegetables, whole grains, lean proteins, and healthy fats can help control blood sugar levels and support overall cardiovascular health.*
- *Physical activity can help improve insulin sensitivity, lower blood sugar levels, and reduce the risk of cardiovascular complications associated with diabetes. Aim for at least 150 minutes of moderate-intensity exercise per week.*
- *Take medications as prescribed by healthcare providers to help control blood sugar levels and manage other risk factors such as high blood pressure and high cholesterol.*
- *Monitor blood sugar levels regularly to track how food, physical activity, and medications affect glucose levels. This helps in making necessary adjustments to the treatment plan.*
- *Smoking can worsen the complications of diabetes, including cardiovascular problems. Quitting smoking can improve overall health and reduce the risk of complications.*
- *Achieving and maintaining a healthy weight can improve insulin sensitivity and blood sugar control. Even modest weight loss can have significant benefits for individuals with diabetes.*
- *Diabetes can affect blood flow and nerve function in the feet, increasing the risk of foot ulcers and infections. Proper foot care, including daily inspection, keeping feet clean and dry, and wearing comfortable shoes, is crucial.*

By taking these steps, people with diabetes can reduce the condition's impact on the blood and lymphatic systems and reduce the risk of complications. However, it is important to work closely with healthcare providers to develop an individualized diabetes management plan that meets individual needs.

In essence, comprehending the intricate alterations in blood and lymph dynamics in diabetes reveals the multifaceted pathophysiological mechanisms underpinning disease progression, paving the way for targeted interventions aimed at mitigating diabetic complications and improving patient outcomes.

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Pedagogical sciences

THEORETICAL ASPECTS OF THE USE OF COGNITIVE AND CREATIVE POTENTIAL IN THE PROFESSIONAL TRAINING OF A TEACHER USING A DIGITAL TEXTBOOK

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Abstract

The article discusses the current state of the use of electronic resources in the system of modern foreign language education. In today's digital age, electronic resources have become an important pillar in the field of education, providing students with a wide variety of learning resources and learning methods. From online platforms to distance learning, the use of electronic resources is gradually changing the face of traditional English language education. The article discusses the results of research on the current state of the use of digital textbooks in modern foreign language education and its role in education, tasks and directions of future development.

With the continuous development of technology, the field of education is also undergoing major changes. In the field of English language teaching, the use of electronic resources has become an indispensable part of teaching. Through online classes, virtual experiments, students can intuitively understand language concepts and improve learning efficiency.

In this era full of opportunities, an in-depth discussion of the current state of the use of electronic textbooks in modern foreign language education will not only help to better understand the dynamics of educational development, but also contribute to the disclosure of their effectiveness in education.

Keywords: digital textbook, education,electronic resource,students,online learning.

Currently, in order to ensure the high quality of education, students actively use electronic resources in the educational process. The use of digital resources in education increases the activity of students and develops the ability to think.

Current level of development of knowledge and technology helps each student to obtain high-quality and in-depth knowledge. The XXI century is an information digital age. Since modern times are the time of scientific and Information Technologies, the approach to education should correspond to it.

One of the main conditions for the use of information and communication technologies in vocational training is to ensure full access of students to the necessary educational materials. On the way to these goals, there is a need for such software products as electronic textbooks, Business games, educational programs.

In general education schools throughout the Republic of Kazakhstan, all electronic technologies are covered. Thanks to the use of these resources, conditions are created for conducting the educational process at the highest level. In the course of e-learning, the following types of educational activities are used: video lessons, practical classes, virtual laboratories, feedback, reflections.

The goals of using electronic resources in the educational process are: formation of qualifications and improvement of skills, motivation to acquire knowledge, control over the lesson process, as well as the development of the ability to information search.

Actually, the use of digital textbooks in teaching English has a number of advantages:

1	*Active interaction*	*Digital textbooks allow students to actively interact with the learning material. They can fill in gaps, mark correct answers, drag items and perform other actions that help them deepen their understanding and memorize the material.*

2	Individualization of learning	Digital textbooks allow teachers to adapt the material to the individual needs of students. They can create different levels of difficulty for assignments, add hints and explanations so that each student can work at their own level.
3	Instant feedback	Digital textbook provide instant feedback to students. They can see the correct answers immediately after completing the task, which helps them understand their mistakes and improve their skills.
4	Interactivity	Use various interactivity elements such as drop-down lists, checkboxes, text fields, etc. This will help students to actively interact with the material and test their knowledge.
5	Variability	Give students the opportunity to choose answers or solutions. This will help to diversify the learning process and take into account the individual characteristics of each student.
6	Assessment of activity and participation	Taking into account the activity and participation of students in the process of completing the interactive worksheet. Evaluate their ability to work independently, ask questions, and interact with other students or a teacher.

[table is created by authors]

Table 1: The use of interactive worksheets

I will show the state of large-scale and comprehensive development of the use of electronic resources in the system of modern biological education. With the continuous development of Science and technology, the education sector is also actively introducing innovative technologies to improve the quality and effectiveness of biological education. For example:

1. Widespread use of digital textbooks and e-books:

With the development of technology and the internet, students gradually moved from traditional paper textbooks to online textbooks and e-books. Through e-books, students have access to the educational materials they need at any time and anywhere to make personal progress in their studies, and this also reduces the workload in educational institutions and reduces paper consumption. Ways to use this resource include :

- Personalized learning path: students can freely choose online learning materials according to their academic performance and interests to form a personalized learning path.

- Reading anytime and anywhere: the use of e-books allows students to access educational materials anytime and anywhere, adapt to different learning environments, and improve the comfort of reading.

- Use interactive features: some online tutorials offer interactive learning features such as online tests, discussion forums, etc., with which students can strengthen knowledge and improve their understanding of the topic.

2. Widespread use of multimedia educational materials :

Multimedia educational materials are widely used in foreign language education. Multimedia elements such as images, video clips, and animations help to visualize educational concepts. This combination of sight and hearing improves the effect of understanding the subject and plays a positive role in the learning process of students. Virtual video recordings help students understand a complex topic. Ways to use these resources :

- Hearing exercises: multimedia materials with audio explanations help students better understand and remember educational moments through auditory channels.

- Interactive learning: some multimedia resources provide interactive features and students can participate in the actual study of subjects by increasing the depth of learning.

Computers and telecommunications are at the heart of information technology. According to S.S Kunanbayeva, the use of technology allows teachers to increase the effectiveness of the educational process, the quality of students' learning, and to assist teachers in bringing the effect of additional

visibility into the classroom, allowing students to learn content more rapidly and in greater quantities. [6, p.12].

In many aspects, the information educational environment surpasses the traditional system of foreign language classes, which have grown known to teachers and have lost significance for pupils, in the context of the State Standard and secondary school program. The benefits of using TBL in the context of learning a foreign language to build an information educational environment in profile schools are highlighted in the following sections:

- through the use of TBL technologies, teachers always have access to the most up-to-date materials and information in the field of foreign language teaching methods; - the educational process has an expanded range of tools and forms of education, which largely correspond to the socio-cultural environment of modern school students and has a positive effect on the level of motivational interest of all participants in the educational process; As a result, methods of teaching a foreign language are constantly being refined, pedagogical experience is accumulated and implemented at the local and regional school levels, and pedagogical technologies are exchanged.

- open such innovative forms of work with educational material as students' participation in virtual discussions and conferences, their presence at broadcasts of children's foreign language and literature competitions, their participation in educational games online, as well as homework and its demonstration using the gadgets they are familiar with (tablet computers, phones, laptops)

The online learning platform provides a convenient interactive space for students and teachers. Students can use these platforms to participate in discussions, share learning resources with classmates, complete online assignments, and more. Such interaction not only promotes cooperation between students, but also allows teachers to better control the learning process of students. Some platforms also offer real-time feedback and personalized learning suggestions to help students better understand and assimilate knowledge. Methods of using these platforms include :

- Lesson discussion: students can participate in lesson discussion through online platforms, share their ideas, interact with classmates, and expand their understanding of language concepts.

- Online homework: teachers can publish their homework through an online platform, and students can complete it for a certain period of time to improve their ability to apply the topic in practice.

- Resource sharing: students can share biology learning resources on online platforms to promote the exchange and dissemination of knowledge.

5. Problems and opportunities of Distance Education :

The widespread use of electronic resources has contributed to the development of distance education.Students do not need to attend school and can take biology courses on a global scale through the internet and online platforms.This provides more opportunities for students with special needs, working people, and international students.However, distance education will have some issues, such as ensuring student participation and solving network problems. Ways to use these resources :

- Convenient study Time: Distance Education provides convenient study time and students can plan their own leisure time.

- Access to global resources: students can acquire various subject resources in Biology on a global scale to increase the level of subject knowledge.

- Remote experiments: for students studying remotely, some virtual laboratories offer online simulation of the experiment so that they can participate in a practical study of the subject.

In the context of the active promotion of electronic resources, the modern biological education system is undergoing a digital transformation.This change provides students with a flexible and personalized way of teaching, as well as promoting the innovation and development of teaching. It is necessary to seriously think about how to balance the benefits of digital education and traditional education and how to ensure the effective use of electronic education.

Conclusion

These changes not only contributed to the innovation of teaching, but also allowed students to gain knowledge and develop practical skills.However, there are still issues with distance education and it is necessary to continue to focus on improving student participation and ensuring the quality of teaching.

In the future, we believe in integrating more technologies and introducing innovative applications in biological education, in addition, we must continue to focus on issues such as equality in education and the digital gap. The continued development of electronic resources continues to determine the future of education, offering students a diverse learning experience.

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THEORETICAL FOUNDATIONS OF THE FORMATION OF NATIONAL VALUES OF STUDENTS IN THE EDUCATIONAL PROCESS OF PRIMARY SCHOOL

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Abstract
This article talks about the theoretical foundations of the formation of national values of students in the educational process of primary school. He focused on and analyzed the opinions of scientists who studied this issue. Revealing the content of the concept of value, it is said how important it is for a person.

Keywords: *value, psychology, pedagogy, universal human value, human life, freedom, spiritual and moral, national values.*

New socio-economic conditions in society require a revision of the essence of education and its final result. Although such personal qualities of a modern citizen as education, the ability to creative search have become the ultimate basis for political and cultural development in the country, the focus of attention of all educational institutions is undoubtedly the formation of the student's personality [1]. Research scientist Kozhakhmetova K. Zh. taking into account the folk characteristics of students from the school curriculum, it is proposed to organize training on the basis of national traditions and customs and combine ethnosocial roles associated with the formation of behavior in accordance with national values. The importance and function of the primary school in the concept of primary education is determined not only by its continuity with other links in the continuing education system, but also by the fact that it is the most valuable, unique link in its formation and development. In elementary school, the child's cognitive and mental abilities improve and he begins to understand how important it is to learn in a person's daily life. In addition, at this age, the student rises to a new level of self-knowledge. Currently, the term" value " is widely used in philosophy, sociology, cultural studies, ethics, aesthetics, psychology, and pedagogy. The field that forms the core of human value and studies it is called Axiology (in Greek axis-precious, "value", logos-doctrine, science). Axiology is the doctrine of the creation of values, its object and the structure of values in the world, that is, various value relationships between social and cultural factors and the structure of values in the world. The Explanatory Dictionary of the Kazakh language states: "value is high value, high value, high value. By value, you can find out the significance, significance, usefulness, necessity of this thing" [2]. In the Kazakh encyclopedia, "value" is understood as a philosophical and social concept that expresses the positive or negative aspects of an object in ancient philosophical views, ethical and aesthetic concepts such as nature, social phenomena, beauty, kindness, kindness are used in assessing human activity, belonging to various value manifestations. Value determines how important an object is to a person. Values include life, work, creativity, the meaning of human life, etc. It consists of a calculation coefficient [3]. In the Philosophical Dictionary: "value" – the recognition of knowledge, a certain thing as sacred to a person, group, Society. There is no dispute about its value, it serves as an ideal, a benchmark for all people [4]. Foreign philosophical and sociological sciences often consider value issues. It is also noted that value is considered by scientists as an aspiration and direction of personal interest and is the basis for choosing one of several proposed objects. R. B. Perry in the XX century, commenting on the concept of "value" in his work "General Theory of values", he attaches great importance to spiritual values and comes to the conclusion that the basis of culture and civilization is not material values, but only socialized and emotionally stable ideas. In his works, Perry classifies values as simple, complex, positive and negative [5]. Philosophers such as A. G. Zdravomyslov, V. P. Tugarinov consider value as a category in the form of significance of a particular phenomenon or thing for a particular person or society. For example, V. P. Tugarinov defines the concept of value as follows: "value is a phenomenon or property of phenomena that are considered useful, necessary and

positive from the point of view of human needs and goal – interests." The scientist identifies the following groups of values: 1) life values: Life, Health, Family, joy in life, relationships with people, etc. 2) material values: housing, food, clothing, equipment, etc. 3) socio-political values: public order, the surrounding World, Freedom, Security, etc. 4) spiritual values: education, science, art. Moreover, in the study of B. I. Dodonov, values divide into two groups. According to its conclusion, the solution of the economic, social and cultural tasks of the state will depend on the understanding of the values of each person in society and compliance with social norms. Only recognized, positive values can guide the formation of correct human behavior. Values are determined by the mind, consciousness, which is determined by the feeling of acceptance or rejection of the ideal. Kazakh philosopher T. K. Gabitov [6], stating that" values are qualities", especially since childhood, assesses that these qualities are built on Mother's milk, as the basis of morality, as a result of mastering its history, culture, customs and traditions. This attitude to value always evokes certain emotions in the subject-pleasure, choice, admiration, etc.This is human life, freedom, morality, family, relationships, personal happiness, offspring, work as a source of existence and an object of action, goodness, authority, legality, kindness. Values not only exist, but are also compared with each other, forming a series of values, a value phase.

Sociologists consider values in the form of a certain rule or sequence of actions. For them, value is the norm that determines the social object, need, significance. Therefore, their main values are:

1) universal human values: human life, freedom, family, human happiness, origin, work, success, cooperation, activity, culture, health, legality.

2) spiritual and moral, national values: culture, literature, history, language, religion, mentality, conscience, shame, honor, honor, traditions, customs, customs, national worldview, kinship, homeland,land, etc.through the internal structure of culture, universal values strive for such values as "meaning", "freedom", "goodness", "goodness", which form the basis of life in order to achieve the goals set for a person. Sociologist B. Erasov says that" the emergence of values, actions that satisfy the needs of a person is carried out with a specific goal." Thus, in Sociological Science, the following types of socio-cultural values are distinguished: political ideals, state history, state culture, state border, tradition, language, etc. [7]. According to the research of the scientists discussed above, we found that the concept of" value " combines two different concepts:

- properties of external properties of objects with value relations (real);

- psychological adjectives of a person who is the subject of these relationships (consciousness);

Material values include the natural need for things, the cost of Labor production, Social Security, centuries-old inheritance, aesthetic properties of natural and social objects. Values in consciousness are social thought, purpose, assessment, various norms. Values are a set of objects that have a good life, have positive qualities, and most importantly, have valuable personal qualities. Values are also the main model for evaluating an event, which is defined as the highest value of the object for the subject. This means that the opinions expressed should approach the concept of value from a psychological and pedagogical point of view. This is because it is necessary to show the value potential in the new generation of society, which will help to form a sense of complete loyalty to the social system of this society. The main direction of our research is also distinguished by the functioning of these values. In the psychological dictionary: the concept of" value "is interpreted as a phenomenon of social historical significance for society, which determines the existence of" personal " life and moral relations in society. In this context, the emergence, formation and manifestation of values occurs in the process of Interpersonal Relations [8]. So, according to psychologist A. N. Leontiev, the concept of "value" is considered in relation to the following three phenomena: 1) social ideals - public consciousness, a public understanding of maturity, maturity, maturity, formed by the norm in various spheres of society's life. 2) objectivity, the implementation of these social ideals in the activities of certain people. 3) the motivational structure of the individual, stimulating the real use of social ideals in his activities. Psychologist V. A. Yadov proposes the following set of values: 1) the purpose of value: love, beauty, Freedom, Family, Health, Work. 2) instrumental values: education, good upbringing, strong will. Values perform regulatory, educational functions in society. Considering the value system in this context, we consider them as prerequisites for linking the concept of "value" with knowledge. In the pedagogical dictionary, "value" means the education in a person of inner correctness, kindness, stability, kindness, kindness in communicating with people, in actions. Because in pedagogy, "value" is realized in the process of Education. In the field of pedagogy, many works have been published devoted to the problem of values. In these works, the concept of value is considered from different angles, special attention is paid to its essence and nature, educational aspects. For example, scientists-teachers M. V. Boguslavsky, M. A. Gusakovsky propose the following hierarchy of values: man, health, life, family, homeland, land, humanity, peace, labor, education, culture,

development. V. A. Karakovsky, special attention is paid to the educational impact of values, suggests the following hierarchy of values: person, health, life, family, homeland, land, humanity, peace, labor, eeducation, culture, development. Kazakh scientists: Uzakbaeva S. A., Zharykbayev K. B., Kaliyev S. K., Kozhakhmetova K.Zh., Orazbekova K., Dzhanzakova. Sh.I., and others consider the concept of value in relation to education. They focused on the heritage of value in the education of generations and contributed to the scientific affirmation and implementation of national values. K. Zharykbayev considers the issue of values from the point of view of national psychology. According to the scientist, value is observed through the importance, benefit, necessity of all types of personal activity, determines actions, goals, motivations, helps in their implementation and greatly contributes to the formation of personality. K. Kozhakhmetova especially appreciates the national spiritual and moral values that inspire and strengthen every person: Universal: - Homeland, family, upbringing, education, love, friendship, peace, equality, freedom, motherhood, religion, art, responsibility, honesty, patriotism, faith, courage, citizenship, respect, mutual understanding, kindness. Ethnicity: - native language, thinking, spirit, repentance, gratitude, Homeland history, Homeland, virtue, loyalty, compassion, satisfaction, pedigree, traditions, seven ancestors, genealogies. Scientist-teacher K. Orazbekova [9] systematizes the pedagogical foundations of the formation of the national personality through the main roots of National Education, identifies intelligence and ingenuity as particularly valuable qualities. In his opinion, the morally valuable qualities of Kazakh wisdom, consisting of ten qualities, are to treat people emotionally, evaluate the correctness of their work, serve their people, not throw secrets to others, be careful in any situation, not to talk, observe decency, be humble, forgive, not interfere in other people's affairs. We see that at each historical stage the issues of "value", "moral value", "national value" are relevant. National values and norms, traditions characterize the social situation of that period, but these values have not lost their relevance to this day. Therefore, using them, it is possible to form the moral values of younger schoolchildren. In conclusion, it is important to teach and improve primary school students to understand and accept the moral values of their people (national), respect their traditions, and become patriotic, cheerful, and patriotic citizens.

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Philological sciences

MULTIMODAL LANGUAGE LEARNING

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Abstract

In the modern educational paradigm, integrating multimodal approaches is essential to cater to the diverse needs of students. This essay highlights how multimodal learning is revolutionizing standard pedagogical approaches. This study presents the basic ideas of multimodal learning in a simple and concise manner, emphasizing how interactive, textual, aural, and visual elements can all be integrated to improve learning immersion. The content follows conventional academic organization and formatting, and the language is exact, neutral, and objective. The material has not been altered. The article summarizes the many benefits of multimodal education, including improved understanding, retention, creativity, and critical thinking abilities, building on the groundbreaking research of scientists. The paragraphs and sentences create a logical information flow with causal connections.

Keywords: Multimodal learning, education, language education, textual-visual-audio integration, digital literacy, teaching methodologies, student engagement, critical thinking skills, language acquisition, modern learning environments.

Multimodality is, at its foundational level, the process of creating value by the combination of multimedia and materials with written, aural, and visible modalities. According to Baldry and Thibault (2006), our society is multimodal at the moment. Contemporary individuals will view the world through multiple senses and, in turn, interpret their experiences through multiple senses, including words, images, gestures, actions, sounds, and other resources. Using several written materials as tools for learning, multimodal instruction enables both educators and pupils to gain knowledge. But as the multimodal era progresses, he talks about many kinds of media data that are used in multimedia presentations, like text, audio, video frames, and more. Multimodality in education could be connected to Fleming and Mills' psychometric Vark model (1992). After assessing students' sensory preferences and talents, the Vark model—which literally translates as "visual," "auditory perception," "reading/writing," and "kinesthetics"—classifies their preferred learning methods (Fleming & Mills, 1992). In particular, flowcharts and other graphic formats are preferred by learners of visual languages when presenting data. Auditory studies learners tend to converse to oneself and attentively to others. Kinesthetics students like engaging in physical activities. A multimedia learning theory put forth by Mayer (2009) contends that having access to numerous input channels—that is, a mix of visual and aural formats—allows pupils to learn more efficiently. The Cook model takes into account multiple approaches to language learning in this manner. In language acquisition, multimodal theory is used, which makes the assumption that students would be more motivated to comprehend and retain language skills if they are taught in a variety of ways (Schewe, 2002). They retain what they received and integrate this more effectively when utilizing pictures, just as whenever employing multimodal visuals. In addition, because of this approach of utilizing pictures, students are not feeling overwhelmed or dissatisfied whereas examining and actually relish discovering more. Multimodality is a major factor in determining the nature of instructional and educational methods in the discipline of educational. Furthermore, multimodality is used in languages as a goal to pinpoint the intricate relationship that occurs between languages and different semantic materials used for conversation. This, according to Norris and Jones (2005), requires integrating a number of modalities, such as words, gestures, and facial expressions.

Having a wide-ranging viewpoint expands the depth of his understanding and enables him to closely examine a variety of methods of communication related to TV, movies, and advertisement. The multimodal learning approach is an attempt to use a variety of techniques (media) or technology that are integrated into a coherent whole to address learning challenges and foster students' creative potential on their own. With the development of the era supporting learning now, teachers need to understand how to implement learning by applying this learning technology so that it can effectively

support learning. In addition, multimodal language learning recognizes that people have different learning preferences and strengths, and therefore it combines various methods, in addition to verbal communication, to improve the language learning process. These methods include:

Visual: Using pictures, movies, and charts as supplementary materials to help reinforce vocabulary and linguistic concepts.

Auditory: The use of sounds to enhance pronunciation and listening comprehension, such as songs, podcasts, and recordings.

Tactile: Enhancing language comprehension and memorization using tactile exercises, textiles, and interactive activities.

Gesticulation: The art of effectively communicating ideas through the combination of gestures, body language, and facial emotions.

Spatial: Considering physical surroundings and spatial placement to produce an engaging learning environment and speed up language learning.

It is noteworthy to acknowledge that multimodality presents primary benefits. The potential of interactive devices to successfully add value to how students learn is one of their main benefits for education. Among these advantages are:

1. The visualization of data: By stimulating the auditory mind, images aid in improving pupils' comprehension and retention of material. Additionally, they improve the content's accessibility for students who prefer visual aids.

2. Audio Information: Auditory components enhance instructional materials by offering a different perspective on the content, which is particularly helpful for students who are audiovisually focused. They also enhance verbal and pictures.

3. Interactivity: Interactive components of multimedia materials encourage students to actively engage in the learning process, which fosters in-depth comprehension and enhances information absorption.

4. Flexibility and accessibility: Students can study educational materials whenever and wherever suits their requirements and schedules thanks to the flexible access offered by digital multimedia formats.

5. Motivation and engagement: Using engaging and amusing digital content helps students become more motivated to acquire knowledge and involved in the method of studying.

6. Animation of instructional content: By presenting instructional content in a variety of formats and styles, multimedia tools enable you to make it clear and accessible to a wide range of pupils.

7. Differentiation of the learning process: Teachers can modify the learning process to each student's unique needs and training level by creating tailored learning resources.

8. Increasing the bounds of knowledge: By making educational content more accessible through multimedia techniques, learners can now investigate ideas and fields of study that had been previously inaccessible owing to a variety of constraints.

The capacity of multimodality to enhance English language skills for learners has led to its growing appeal in the EFL area. Reflection, the growth of imagination, and higher-order thinking are all encouraged by multimodality. It can foster intellectual skills and student participation, in contrast to traditional learning (Haren, 2010). Walsh (2010) notes that the qualities of reading, writing, speaking, and listening skills are impacted by the usage of multimodal approaches in language learning. Furthermore, multimodality enables learners to view how they learn in an approach that makes it most enjoyable for them, even if they get dissuaded by linguistically driven instruction. As a result, multimodality offers a variety of instructional approaches for learners who are not linguistics-oriented.

Al-Fajri (2019) asserts that it is critical to employ a variety of methods in instruction. In terms of multimodal learning, it must be noted that interacting with multimodal literature in EFL classes may be utilized to build the comprehension of pupils, written form, and auditory skills in addition to their ability to read. This may assist to solidify a comprehensive strategy to acquiring each of the four abilities. Additionally, the multimodal method guarantees a presence that promotes cognitive abilities and enables learners to benefit from many different experiences during learning. In an educational language setting, this enables educators to fulfill the requirements of various individuals.

Students are going to be inspired more to learn and maintain an ability to speak if it is taught by others in a variety of ways. Consequently, educators may benefit from multimodality in teaching English as a second language. By doing this, you may optimize the advantages of technology and modern literacy in education. Students can extend their interpretive skills beyond cognitive processes by utilizing multimodal technologies.

While utilizing every technique independently, the supposed multimodality may send a distinctive signal that wasn't able to be delivered with the same effectiveness. Accordingly, multimodality encompasses all forms of communication and representation and makes use of all available means to produce meaning that individuals employ in diverse circumstances (visual, audible, gestural, among others).

Conclusion

In the educational process, multimodality has grown to be an effective tool that is changing both the way we educate as well as how children understand. She understands the complexity of human communication, which includes gestures, noises, visual effects, and spatial components in addition to words.

Multimodality in the context of EFL extends beyond language proficiency. It fosters creativity, critical thinking, and a more comprehensive grasp of communication in general. Teachers establish a welcoming environment that accommodates a range of abilities and preferences through a variety of techniques. Its all-encompassing method enables learners to gain an in-depth understanding of the language acquisition, which enhances their ability to communicate and improves their overall academic performance.

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Sociological sciences

THE İMPORTANCE OF SOCİAL ACTİVİTY İN POSTWAR PERİOD

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Abstract

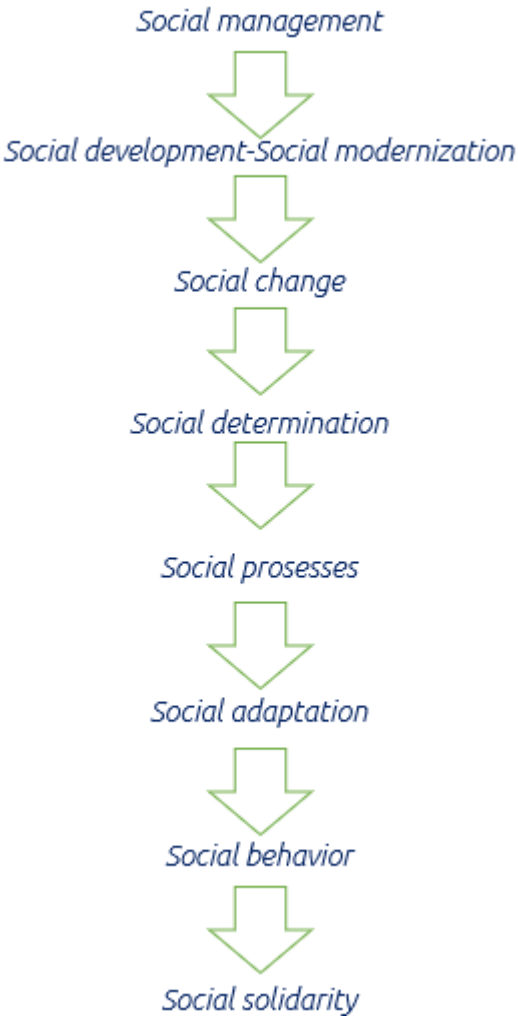
Throughout the centuries the countries of the world have experienced a period of war. The consequences of the war are a serious obstacle to the development of the society. Nevertheless, society must develop. The period of self-recovery of the country belongs to the post-war period. Management is also directly proportional to development. When the degree of development is high, the development in management will also be noticeable. If the management method is not chosen correctly we create the basis for recession. The basis of social development is to improve the well-being of every individual in society. That's why they can reach their potential.

Keywords: *social management,social project,socail modernization,social development,society*

"The success of society depends on the well-being of every citizen. Social development means investing in people. It requires the removal of barriers so that all citizens can reach their dreams with confidence and dignity. It's about not accepting that people living in poverty will always be poor. It's about helping people to move forward on the road to self-sufficiency".[1] To build a high welfare society, it is necessary to build a modern society. The high level of literacy brought about by secularization led to differentiation in science and activity, which in turn led to the establishment of modern society. Taking into account that modernization is created on the whole sphere, the process of social modernization should be considered first. Social modernization is associated with social development brought about by social change in the direction of increased differentiation of the social structure. From this it can be concluded that the strengthening of social management is essential for the strengthening and improvement of social development with the establishment of a socially modernized society.There will be no basis for social management without these two factors. During the development stage of social management several factors are taken into account in addition to the above-mentioned factors. These include:

Social project - Social planning - Social technologies - Organization

Social project and social planning are a theoretical direction in management. Social technologies are the choice of management application method. At the last stage, management work is carried out. The society that has passed this stage is able to manage successfully. In turn, this promotes social development and the establishment of a modern society. Social development and social modernization are broad concepts. To understand this activity let's focus on the following scheme to explain more clearly the dynamics of development and dependence between them.



All the factors mentioned above are interrelated. Each of them is a participant in social management. It will not be possible to explain the functionality of social management without considering these factors. The phenomenon of change has gained relevance since the formation of mankind until today. Although there are many classifications of change social change is always special importance. Because both the starting point and the end point of the activity is the society. The change in the social sphere is being carefully studied from this point of view. The positive side of social change is achieving social development of the society. Social determinism, which is one of the principles of social philosophy defines regularity in social management. Social determinism also emphasizes the importance of social processes in determining alternative ways of achieving productivity in social life. Social processes are the basis of social change. According to the result of social change social processes can be competition, conflict, adaptation, compromise or assimilation. The type of social management is selected according to the type of social process. This option has a different character for each country. So, at this time the political leadership, economic situation, foreign relations, social life of that country are taken into account. In any case, this process must be adaptive.

Conclusion

The post-war period is also a period of adaptation. Because in order to ensure the normal life activity of the sensitized society, the adaptation of the entire social system of the society must be ensured. For the successful provision of this stage, the social behavior of those who are controlled by managers is of special importance. Because any deviant behavior in the implementation of social relations and relations between them will lead to deconstructive results. For this, an interface of community members should be established.

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Technical sciences

PECULIARITIES OF FACE RECOGNITION

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Abstract

Currently, facial recognition is widely used in access control, passport, payment, and device applications. Speed and accuracy of recognition are important in this. The increasing demand for fast and high-precision applications in various spheres of society's life and activity shows the relevance of this issue. The implementation of these technologies is especially important in the areas of object protection, banking, forensics, identification of wanted persons, assessment of a person's gender, age, and emotional state.

Keywords: *face image, recognition, model, algorithm, principal components, base vectors, normalization.*

Facial recognition technology is a system for comparing faces in a video or image with pre-existing facial image data [1]. In this case, the existing face image can be taken from any face image database or documents. Despite the fact that facial recognition technology was created several decades ago, recent advances in this field have made this technology a common occurrence in our daily lives. This can be explained by the widespread implementation of facial recognition applications in many devices and applications.

The face recognition system is primarily based on the human recognition mechanism and is developed based on modern approaches. Modern facial recognition systems are based on the latest technologies and have been tested on complex databases. For example, in China, such systems are widely used for personal tracking. In the USA, it is widely used in immigration and customs control, as well as in checking driver's licenses. However, how well does facial recognition work? - question appears. The answer is generally good, but in some cases it makes mistakes. At this point, a natural question arises as to what factors have a strong influence on the recognition result. In general, face recognition technology compares the face image in front of special cameras with the face image in the watch list. Usually, a list of people to be watched is created in advance and their face images are attached to the list. Nowadays, there are many types of face recognition technology, but almost all of them are implemented in the following stages.

Stage 1. Face detection. *At this stage, the camera detects the face and its location. In this case, there may be one or more faces in the image, and the person in the image may be in portrait or profile*

position.

Stage 2. Facial analysis. *At this stage, based on the result of stage 1, an image is taken and the face image is analyzed. Many existing technologies use two-dimensional facial imaging. The algorithm studies the geometry of the face and determines the key factors in it. The purpose of identifying key factors is to identify the main features that distinguish a particular person from others.*

Stage 3. Transferring face image to data. *In the analysis process, the face image is converted into a digital data representation based on facial features. By its content, face analysis represents a mathematical formula. The generated code is called "facial print", and each person will have a unique and unique "facial print", as in fingerprints.*

Stage 4. Search for similarities. *In this case, the "face trace" is compared with the face images in the database of face images and the most similar image is determined. If the image is 3D, then the comparison is made without changes to the 3D image base. The image is 2D, but when the base is 3D, the base image is divided into 2D images and the comparison is made based on them.*

Among all biometric technologies, facial recognition is relatively natural. In general, the problem of verification or identification of a person through a facial image can be solved. In verification, the face image is compared to a single image in the database, and in identification, the face image is compared to all images in the database. In this case, the comparison can be made by some comparison method [2].

Special models, methods and algorithms make it possible to describe the image of a human face with high accuracy. However, it is important not to forget the attacks carried out through the image of the face.

Researchers have included the concepts of partial and highly manipulable and non-manipulable objects, face and its expressions, living objects, printed features, bright [3]. The manual focuses on the face and its expressions, where it is important to understand how a person recognizes a face from a psychophysiological point of view. That is why many researches in recent years have been devoted to the problem of human face recognition. One such study [4] was carried out by the authors of the work, in which it was mentioned that a person can distinguish a facial expression even in a small unit of time. In this direction, it is worth noting A.L. Yarbus's experiments based on the principle of dynamic recognition. It states that a small movement of the human eye provides a sufficient level of complex activity and that it consists of several movements. A person needs a lot of experience to understand the object. Because a person uses the images in his memory to understand the images. Eye movement may cause the image to be slightly blurred when viewing. A person understands the image well, independent of eye movements. This is called the problem of "spatial constancy of vision" [3].

In recognition, the human brain performs the task of checking the correctness of recognition. In computer systems, this task is performed on the basis of special methods and algorithms. Currently, many recognition approaches have been developed, which are based on the evaluation of facial image features. The distribution of the location of the set of points on the face and the transformation of the facial details are popular approaches to form a reference face. [4] the authors of the work conducted recognition experiments on animals. In this, they were shown a randomly taken image of a face and the changes in the part of the brain that responds to recognition were analyzed and the group of neurons responsible for recognition was identified. It can be concluded that a person uses such a strategy for recognition. Scientific research and experiments conducted by Fraser and Parker [5], Tanaka and Farakh [6], Yushchenko and Meshcheryakov [7] on human face recognition are noteworthy. It was emphasized by the authors of [5] that the completeness of the face in the image is one of the main factors that positively affects the recognition quality. [3] conducted experiments on racial affiliation, in which it was found that people are better at recognizing people of their own race. However, IBM has presented its rationale for exiting the facial recognition system market [8-9], and they are very concerned about racial misidentification, which could lead to racism by law enforcement officers [10].

[5] the authors of the work used the R statistical data processing language to evaluate the results of psychological research. R is a free programming language under the GNU license, which is essentially a statistical environment and mainly performs statistical calculations [11]. Similar to R, there is also a language called C, which is closed source. R does not lag behind other competitors due to its open source code and many options. The evaluation of experimental data is based on the psychological researches in works on face recognition [5-6]. At the initial stage, a database of 500 facial images was created. In this, facial images are classified in their entirety. According to the results of the research, it was found that the integrity of the face in the image depends on the recognition time and has a strong influence on it. However, the presence of signs characterizing external factors does not significantly affect the response time. Humans recognize familiar or famous people at almost the same rate as strangers. In [12], it is

shown that it is not appropriate to use an analysis such as dispersion analysis, which assumes a certain distribution.

The study of facial recognition began in the early stages of computer vision. Currently, many automatic and automated systems for recognizing a person based on a facial image have been developed. In order to improve the accuracy of such systems, various approaches, methods and algorithms [13-25] have been developed and are still being improved. Examples include Karunen–Loev, graph comparison, principal components, hidden Markov models, neural networks, and appearance active models. The main difference between them is in the method of extracting features and recognizing them. In general, image processing in face image-based recognition is performed in two steps. In the first step, the presence of a face in the initial image is determined and its localization is performed. In the second stage, recognition is carried out. In this case, facial image alignment, feature calculation [26-28], and recognition based on the calculated features are performed.

Identity recognition is widely used in solving practical problems, such as automatic control of access to a building, room, program, etc., and searching for an unknown person in a database. The results of solving these problems depend on the pre-processing of the images, and the better it is done, the more effective the result will be. Therefore, one of the main goals of this work is to improve the quality of the input image.

Suppose we are given A-image, F-some rule (algorithm or method), I-criterion. Then, when the selected rule is applied to the given image, let the criterion reach its maximum value $I\left(F\left(A\right)\right)\to\max$ *. The general scheme of image recognition is shown in the figure below.*

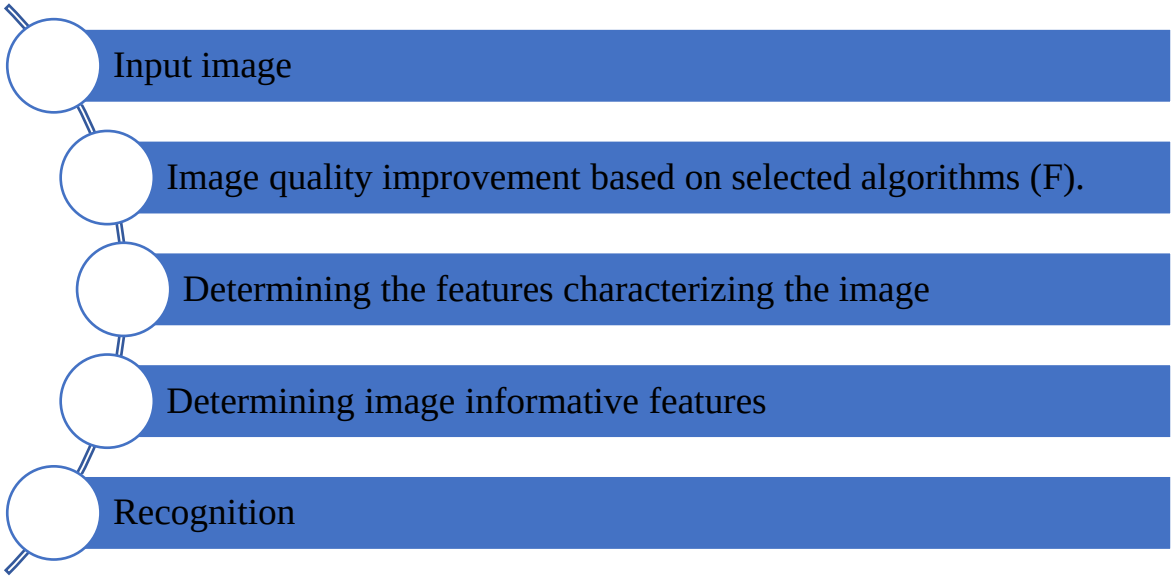

Fig. 1. General scheme of recognition

The recognition algorithm must be aimed at the automatic localization of facial elements with the highest possible accuracy. Localized facial features are used for recognition. A peculiarity of this is that there is no comparison with statistically significant data in the database of facial images [3]. Usually, recognition of a person on the basis of a face image is done in two ways, that is, by comparison with one-to-one or a certain base of face images. Comparison of face images by geometric features is based on elements such as eyes, nose, lips, eyebrows and jaw. In this case, the recognition of the person can be done well even when the elements are not visible enough. The content of this approach is to correctly determine the relative position of the characteristic features and elements of the face image.

Comparison with the groundtruth is performed by matching metric over the entire facial groundtruth, a reflection byte array expressed as intensity values. Currently, there are many ways to generate groundtruths and express them. For example, the approach of representing the face as a set of different small groundtruths is effective, but it is more efficient to use a set of groundtruth units with precise a priori models that allow estimating the main changes in the face, and it represents the basis of the deformable groundtruths method [3]. First normalization is done and eyes are identified. The face image is automatically normalized in scale and position based on the location of the eyes. This allows benchmarking to be performed on specific face elements. Experiments have shown that it is possible to recognize a face with the highest accuracy using a combination of whole-face and groundtruth

comparison approaches. Nowadays, methods such as adaptive comparison, principal components, Viola-Jones, basis vectors, bar code formation are popular and widely used in graphs.

The essence of the flexible comparison method in graphs is to elastically compare graphs representing face images. In this, the face image is represented by graphs with measured edges and vertices. In the recognition phase, a single graph is fixed as a reference graph. The shape of the other one is changed in order to bring it closer to the standard [29]. In recognition systems, graphs are used in the form of a rectangular grid or a structure of eigenpoints. It is important to perform deformation for images in the entire database. The disadvantage of this method is that the recognition process requires a very complex computing resource, it is difficult to create new groundtruths, and it depends on the size of the face image database. Despite its shortcomings, this method provides a relatively high level of recognition.

Discrete-time hidden Markov model (DMM) is also widely used in face recognition systems [20-32]. This model is a statistical recognition method, which uses the statistical properties of the signal. The set of latent and observable states, the probability transition matrix, the probabilities of the initial states are the elements of GMM, and each of them has its own Markov model. At the stage of object recognition, the Markov model formed for the given base objects is checked and those with maximum probabilities are determined from the sequence of observations formed on the basis of the appropriate model for the object [3].

The main drawback of the method is the selection of model parameters in each face image database and the training algorithm that maximizes the response of the face image only to its own model.

Another popular method for facial image recognition is PCA, the main idea of which is to represent a face image in the form of a set of principal components of the image, which is called a characteristic face [33]. In this case, the characteristic face image corresponds to the face shape vector. The principal components are calculated by calculating the eigenvectors of the image and the eigenvalues of the covariance matrix. Multiplying the sum of principal components by the corresponding eigenvectors is called image reconstruction. Usually from 5 to 200 principal components are calculated for each face image. Recognition is performed by comparing the calculated principal components of images. In this case, all images belonging to one person are considered as one class and used to recognize all of these images. PCA based on Karunen-Loev substitution is now popular and widely used in many recognition systems [6]. PCA has justified itself in solving practical issues. However, the performance of PCA is greatly reduced when the face image has strong luminance and facial expression changes. This is due to the fact that the PCA selects the part space in order to maximally approximate the set of incoming face images and does not discriminate between face image classes. This problem can be solved by Fisher's linear discriminant [34].

Another statistical model of the face image is the appearance active model, in which the image is approximated to the real image through different representations of deformation [35]. An active appearance model has parameters related to shape and statistical model or texture. This model must be trained on a predefined image database before being used. In this case, marking is done manually and they are required to be feature points [36]. In this method, the final model of the face is formed based on the combination of shape and appearance model. In this, a specific facial image model is determined by solving an optimization problem, and the model features generated represent the location of the model in a specific image. The active appearance model has many parameters, some of which serve to represent the shape of the face.

There is also a shape active model, which is similar to the appearance active model. The shape active model is also a shape statistical model, which allows to determine the statistical relationships between the anthropometric points of the face image in a selection of frontal face images [37]. Usually, anthropometric points are selected by experts. In this case, the numbering of points must be done the same for all images. It is known from many literatures that researchers conducted research based on different number of anthropometric points. In order to bring all images to a single coordinate system, a general stretching analysis is performed. As a result, all points of the image are centered and transferred to a single scale. After that, the mean shape and covariance matrix are calculated for all samples. Based on the calculated covariance matrix, the eigenvectors are calculated and sorted in descending order. The main purpose of active appearance model and shape active models is not face recognition, but more accurate localization of the face.

Currently, there are several views of the neural networks involved in facial image recognition. One such representation is a network in the form of a multilayer perceptron. Neural networks used for facial image recognition are trained on a database of face images called training samples. The purpose of

training is to determine the value of the weights of the neural network, in which the optimization problem is solved by some optimization method. In neural network training, significant features, their importance, and degree of correlation are automatically determined. And the ability to generalize neural networks makes it possible to recognize new facial images.

Convolutional neural networks have shown the best results in face recognition [38-40]. The reason for this is that convolutional neural networks take into account the two-dimensional topology of the image. In addition, convolutional neural networks are more stable than other types of neural networks to changes such as scale, shift, rotation, and perspective [43]. The DeepFace system was created on the basis of convolutional neural networks, which is quite popular [3].

Despite the many achievements of neural networks in face recognition, they also have some drawbacks. For example, adding a new face image to an existing database takes a long time. In addition, there are also challenges related to neural network architecture selection and training. In short, the interpretation of neural network output is complicated [42].

Before performing almost all of the methods described above, it is necessary to properly configure and install the camera, as well as transfer all face images to a single coordinate system. For this, it is necessary to determine the points that best represent the image of the face. Many studies have used anthropometric points, eye edge points, and pupil centers as good representative points, and a maximum of 10 such points were obtained in order to reduce the number of calculations [39].

Researchers have used the Viola-Jones algorithm [43-44] as the main method for image object detection for many years. However, this algorithm lags behind modern algorithms in terms of speed. However, its improved variants are widely used in facial recognition. The main reason for this is their high accuracy. The Viola-Jones algorithm uses the sliding window method and Haar wavelets as a feature in recognition. At first, the algorithm is trained on test samples. While the algorithm is slow to perform training, it performs recognition relatively quickly. The Viola-Jones algorithm has advantages such as identifying as many objects as possible from the image, using simple classifiers, adding new objects, checking the sign, making relatively few errors in object detection, and being available in open sources. Disadvantages of the algorithm are that it requires and depends on a large amount of test images, takes a long time to train, is very sensitive to warping, and produces many close results.

The method of support vectors is also widely used in face detection and recognition. This method allows to determine the hyperplane separating face and non-face images in the character space [45-46]. It is almost impossible to separate complex classes linearly. However, this problem can be solved by the method of base vectors. The basis vector method is a powerful classifier used in the recognition stage and is widely used in recognition systems [47-48].

The method has the following advantages and disadvantages: quick determination of the decisive functions, ease of quadratic programming in the bubble area with a unique solution, determination of the dividing line with the maximum length are the advantages of this method. The main disadvantages of the method are its sensitivity to variables, the need for data standardization, and the lack of a general approach to automatic core recognition.

Another way to identify a person based on a facial image is the "biological barcode" method, which was first introduced in electronic payments. This method is based on Dakin and Watt's idea that all the information on the human face is in its horizontal lines [49]. However, the use of such codes in face recognition requires the fulfillment of many requirements and the solution of some problems [50].

Facial recognition technologies are widely used in crowd analysis, customer service, digital account opening, device security, marketing and advertising, alcohol sales, security, and crime prevention. In particular, the world's largest companies, such as Amazon, Apple, British Airways, Cigna, Coca-Cola, Facebook, Google, and McDonald's, are effectively using facial recognition technologies in their activities.

Facial recognition technologies are considered to have advantages such as increasing security, reducing crime, speeding up searches, speed, and easy integration with other technologies. Despite having many conveniences and achievements, this technology also has a number of disadvantages. For example, brightness, head position, facial expression, cause many problems in systems based on face recognition technologies.

Every year, FERET conducts research on state-of-the-art facial recognition systems in databases with more than one million face images [53]. However, in their reports they cite the results of commercial systems rather than systems development approaches. This year, in a report presented by FERET, NEC's NeoFace program was recognized as the best. Large-scale testing was performed using FERET software for flexible graph matching and all forms of BKU, where all algorithms showed almost the same performance. Therefore, it is impossible to tell their difference in advance. Based on the data presented

in [3], it can be concluded that it is necessary to further develop face recognition technologies. The next step in biometrics is the recognition of human behavior and emotion, and many results are being obtained in this regard.

Conclusion

The future of facial recognition technologies is not yet known. At the moment, there are different views and debates about the future use of this technology. However, many organizations are implementing this technology in themselves. Therefore, facial recognition technologies cannot be considered completely closed. Currently, many researchers are trying to analyze features such as race, age, and gender through the face. In addition, they are also studying the effects associated with face masks and various diseases. The development of this technology invites him to study its real value and ethical problems. Future authentication and identification solutions will rely on all aspects of biometric technologies, resulting in a more reliable biometric mix. This approach provides a higher level of security.

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CONSTRUCTION OF A NEUTROSOPHICAL LOGICAL MODEL

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Abstract

Currently, there is a growing need to develop data analysis and decision-making methods that can take into account uncertainty and fuzziness in information. The Neutrosophical Logic Model is an effective tool that allows one to model such conditions and make decisions in the context of fuzzy and uncertain data. This abstract discusses the relevance of the construction of the neutrosophical logic model and its application in various fields such as artificial intelligence, expert systems, risk management and decision making. The main advantages and characteristics of the neutrosophical logic model are also discussed, including its ability to account for uncertainty, model fuzzy concepts, and integrate with other data analysis techniques. This abstract provides an overview of key aspects of the neutrosophical logic model and highlights its relevance in the modern world of information technology and decision making.

Keywords: *neutrosophical logic model, decision-making, fuzzy logic, classification, union, intersection.*

1. Introduction.

In the modern information society, characterized by an increase in the volume of data and an increased degree of uncertainty, there is a need to develop effective methods for analyzing information and making decisions. Traditional methods based on classical logic and probability theory are often insufficient to account for the fuzziness and uncertainty inherent in many real-world situations. In this context, the neutrosophical logic model represents a modern and promising approach to account for fuzziness and uncertainty in data. Neutrosophical logic, based on ternary logic, expands the capabilities of classical binary logic, including an additional meaning - uncertainty. Thus, it provides more flexible and powerful tools for data analysis and decision making under uncertainty [1].

Neutrosophical fuzzy set is a concept that combines elements of fuzzy logic and neural network approaches. In fuzzy logic, each element of a set has a degree of membership in this set, expressed as a number from 0 to 1. Neural network approaches are used to analyze data and train computer systems based on the functioning of neural networks that imitate the functioning of the human brain. The neutrosophical fuzzy set includes elements of both approaches. It is used to model uncertainty and fuzziness in data, and to process information when precise values are unavailable or uncertain. Such methods can be useful in solving problems of classification, forecasting and decision making under conditions of uncertainty. The neutrosophical set and neutrosophical logic are parts of the general direction in the research of fuzzy logic developed by Lotfi Zadeh [2-3].

In fuzzy logic, each element has a degree of membership in a set, while in a neutrosophical set, each element is characterized by three parameters: truth, falsity and uncertainty. This allows for more flexible modeling of various situations where uncertainty plays an important role. In neutrosophical logic,

in addition to the classical meanings of "true" and "false", the meaning of "uncertainty" is also taken into account. This allows us to more accurately take into account the degree of uncertainty in statements and reasoning. Both of these concepts - neutrosophical set and neutrosophical logic - are aimed at processing fuzzy and uncertain information, which makes them useful in various fields such as decision making, knowledge management, artificial intelligence and others [4].

In real-life situations, there are often situations where information is not completely accurate or complete. The Neutrosophical Logic Model allows for uncertainty and fuzziness in data to be taken into account, making it an important tool for analysis and decision making in such settings. Many concepts in the real world may not be clearly defined. For example, the concepts "tall" and "short" may have different meanings for different people or in different contexts. The Neutrosophical Logic Model allows one to model such fuzzy concepts and make decisions based on fuzzy data. In various fields such as expert systems, artificial intelligence, risk management, etc., it is important to be able to make decisions under conditions of uncertainty. The Neutrosophical Logic Model provides tools for analysis and decision making in such environments, thereby reducing risk and improving the quality of decisions made. The Neutrosophical Logic Model can be used in conjunction with other data analysis methods such as neural networks, genetic algorithms, machine learning algorithms, etc. This allows you to create more complex and effective analysis and decision-making systems. Thus, the construction of a neutrosophical logical model is relevant in the modern world, where data is often not absolutely accurate or complete, and requires analysis and decision-making taking into account uncertainty and fuzziness.

The purpose of this study is to review and analyze the neutrosophical logic model in order to identify its applicability and effectiveness in various fields. Specific research objectives include:

Study of the basic principles and concepts of the neutrosophical logic model, including ternary logic and the consideration of uncertainty.

Analysis of the advantages and limitations of the neutrosophical logic model compared to traditional data analysis methods.

A study of examples of the application of the neutrosophical logic model in various fields such as artificial intelligence, expert systems, risk management and decision making. Assessing the effectiveness and potential of the neutrosophical logic model in solving specific problems under conditions of uncertainty and fuzziness of data. Formulating recommendations for the application of the neutrosophical logical model in various fields and further research in this direction. By achieving these objectives, the study aims to identify the potential of the neutrosophical logic model as a modern tool for data analysis and decision making under conditions of uncertainty.

2.Materials and methods.

To carry out the study, a review of scientific literature was carried out, including articles, books and scientific publications on the topic of the neutrosophical logic model, ternary logic, fuzzy logic, as well as their application in various fields. Operations with neutrosophical sets are similar to operations with classical fuzzy sets, but take into account additional parameters of truth, falsity and uncertainty for each element. Here are the basic operations with neutrosophical sets:

Union: Given two neutrosophical sets A and B, the union A∪B is computed by combining elements from both sets, taking into account their truth, falsity, and uncertainty characteristics.

Intersection: The intersection A∩B of two neutrosophical sets is calculated similarly, given the corresponding elements from both sets.

Complement: The complement A' of a neutrosophical set A is determined relative to the complete neutrosophical set, taking into account the truth, falsity and uncertainty of each element.

Intersection with Complement: This operation allows you to calculate the intersection of one neutrosophical set with the complement of another.

Complement of Intersection: This operation allows you to calculate the complement of the intersection of two neutrosophical sets.

Membership: Determines the degree to which an element belongs to the neutrosophical set, taking into account its truth, falsity and uncertainty.

These operations are used to analyze and process fuzzy and uncertain information within the framework of neutrosophical logic and can be applied in various fields including decision making, knowledge management and data processing.

Let x be an element of the set, T(x) its degree of truth, F(x) its degree of falsity, U(x) its degree of uncertainty.

Let us denote the combined neutrosophical set as CNS=ANS∪BNS.

Then for each element x from the sets ANS and BNS, its characteristics in the set CNS can be calculated as follows:

TC(x)=max(TA(x),TB(x))

FC(x)=min(FA(x),FB(x))

UC(x)=max(UA(x),UB(x))

where TC(x), FC(x), UC(x) are the degrees of truth, falsity and uncertainty of element x in the combined CNS set, respectively.

Thus, each element of the united neutrosophical set will have its own characteristics of truth, falsity and uncertainty, taking into account the values

The arithmetic of addition of two neutrosophical sets involves the summation of their elements, taking into account their characteristics of truth, falsity and uncertainty. Suppose we have two neutrosophical sets ANS and BNS, and we want to perform the addition operation ANS+BNS to obtain some new neutrosophical set CNS.

For each element x from the sets ANS and BNS, its characteristics in the set CNS can be calculated as follows:

TC(x)=TA(x)+TB(x)−TA(x)×TB(x)

FC(x)=FA(x)+FB(x)−FA(x)×FB(x)

UC(x)=UA(x)+UB(x)−UA(x)×UB(x)

where TC(x), FC(x), UC(x) are the degrees of truth, falsity and uncertainty of element x in the combined CNS set, respectively.

These formulas allow us to take into account the interaction between truth, falsity and uncertainty when performing the operation of adding neutrosophical sets. Examples of applications of the neutrosophical logic model in various fields such as artificial intelligence, expert systems, risk management and decision making were analyzed. This made it possible to evaluate the effectiveness and applicability of the model in practice. Neutrosophical logic is indeed a generalization of many existing logics and offers an interesting approach to describing logical statements in three-dimensional neutrosophical space. In this space, each statement is characterized by three dimensions: truth (T), falsehood (F) and uncertainty (I).

For engineering calculation software, the classic unit interval [0, 1] can also be used for simplification. It is important that the components T, I and F are independent and can be of various combinations, allowing different aspects of information and its ambiguity to be taken into account. To test the applicability of the neutrosophical logical model in specific situations, mathematical models were developed and computational experiments were carried out. This included formalizing the problem, defining ternary variables and operations, and analyzing the simulation results.

The neutrosophical set in this context is defined as a subset of the set of propositions U, which is represented by the elements x(T,I,F), where T, I and F represent the percentage of truth, uncertainty and falsity, respectively. For an element x from the set U that belongs to the neutrosophical set M, the degree of its membership in M is determined by the percentages %t%, %i% and %f%, which represent the degree of truth, uncertainty and falsity in the set M. Here t varies in T,i changes in I, f changes in F. Statistically, T, I and F can be represented as subsets, but dynamically they are operator functions, which means they can change depending on the context or conditions. This allows us to take into account the variability in the degree of truth, uncertainty and falsity for elements of the neutrosophical set in different situations or time points.

Neutrosophical probability is a generalization of classical probability and imprecise probability. In neutrosophical probability, the chance of event A occurring is defined as t% true where t is in subset T, %i% indeterminate where i is in subset I, and %f% false where f is in subset F. In classical probability n belongs to the interval [0, 1], while in neutrosophical probability n belongs to the interval [3+]. In fuzzy probability, each event has a probability represented by a subset T[0,1], but not by a number p from the interval [0, 1]. The subset F also belongs to the interval [0,1]. In crisp probability there is no indeterminate subset I.

Neutrosophical statistics analyzes events described by neutrosophical probability. A function x that models the neutrosophical probability of randomly chosen variables is called the neutrosophic distribution: NP(x)=(T(x),I(x),F(x)), where T(x) is the probability that x will occur , F(x) is the probability that the value x will not occur, and I(x) is the unknown (unknown probability) of the value. To test the effectiveness of the model, experiments were conducted on real or synthetic data. This included data collection, preprocessing, application of the neutrosophical logic model, and analysis of the results.

Neutrosophical logic is a branch of logic that extends and generalizes classical logic to take into account uncertainty and fuzziness in statements and reasoning. Unlike classical binary logic, where statements can only be true or false, neutrosophical logic allows for a third element - uncertainty. The basic principles of neutrosophical logic include:

Ternary logic: In neutrosophical logic there are three basic meanings for statements: truth, falsehood and uncertainty. This makes it possible to more accurately account for fuzziness and uncertainty in real-world situations.

Neutrosophical Conclusion: Conclusions in neutrosophical logic can be based on three values - truth, falsity and uncertainty. This allows for more flexible conclusions given the uncertainty in the data.

Extended operations: Neutrosophical logic offers advanced operations such as neutrosophical union, intersection and set complement, which take into account uncertainty.

Modeling fuzzy concepts: Neutrosophical logic is widely used to model fuzzy concepts such as "high", "low", "fast", "slow", etc., which cannot be uniquely defined. Neutrosophical logic finds application in various fields such as artificial intelligence, decision making, knowledge management, expert systems and others where uncertainty plays an important role.

3. Result. A comparative analysis of the neutrosophical logic model was carried out with traditional methods of data analysis and decision making. This made it possible to identify the advantages and limitations of the model compared to other approaches. The materials and research methods made it possible to conduct a comprehensive analysis of the neutrosophical logic model and evaluate its effectiveness in various fields of application. The results obtained allow us to draw conclusions about the potential of the model and identify directions for further research.

The functionality of the program for constructing a neutrosophical fuzzy model of the Sugeno type may include the following aspects:

Input of initial data: The user can enter initial data, such as parameters and characteristics of the system or situation, on the basis of which the model will be built.

Definition of fuzzy variables: The program allows you to define fuzzy variables and their linguistic meanings that will be used in building the model.

Creating Rules: The user can create rules that define the logic of the model based on input variables and their values.

mathematical formalization of the neutrosophical logical model:

Ternary values:

Statement P can take one of three meanings:

True (T)

False (F)

Uncertainty (I)

Neutrosophical operators:

Union of neutrosophical sets: A∪B

Intersection of neutrosophical sets: A∩B

Neutrosophical set complement: 'A'

Neutrosophical rules of inference:

Introduction: If P is true, then P is true.

Remedy: If P is false, then P is false.

Attenuation: If P is indefinite, then P is indefinite.

Uncertainty Modeling:

A neutrosophical set A can be represented as A={(TA,IA,FA)}, where TA, IA and FA are the degrees of truth, uncertainty and falsity, respectively, for the elements of the set A.

Let's build a mathematical model of fuzzy logic of the Sugeno type. This model uses fuzzy rules expressed in the form of "if-then" where each "if" has a truth value for all input variables, and each "then" determines the contribution to the output depending on the values of the input variables.

Let's say we have two inputs x and y, each of which belongs to the interval [0, 1], and one output z, which also belongs to the interval [0, 1].

Let us have fuzzy rules:

If x is "small" and y is "big", then z is "tall".

If x is "big" and y is "small", then z is "short".

where "small", "large", "high" and "low" are linguistic variables with their fuzzy values, which are defined on the interval [0, 1].

Mathematically, this can be expressed as:

If x and y have fuzzy values x1 and y1 respectively, then the output z1 for the first rule will be: z1=μhigh(x1)×μlarge(y1).

If x and y have fuzzy values x2 and y2 respectively, then the output z2 for the second rule will be: z2=μlow(x2)×μhigh(y2),

where μhigh(x1), μlow(x2), μlarge(y1) and μlarge(y2) are the membership functions for the corresponding fuzzy sets.

Finally, for the neutrosophical logic model, we could also add a degree of uncertainty Iz for each rule to account for the possibility of uncertainty in decision making. Thus, the mathematical formalization of the neutrosophical logical model involves the use of ternary values, operators and inference rules for working with fuzzy and uncertain information. The program provides a choice of different membership functions to determine whether fuzzy variables belong to certain linguistic meanings. To determine the output of the model based on the input data and rules, the program uses fuzzy inference algorithms, including the Sugeno algorithm. The user has the ability to visualize the simulation results, for example through graphs or charts, to better understand the impact of various parameters on the output data. The program can provide tools for assessing the effectiveness of the constructed model based on comparison of modeling results with real data or expert estimates. The user can save the built models for later use or download them for further analysis or modification. These functionalities allow users to create, analyze and use Sugeno-type neutrosophical fuzzy models to solve various problems in various fields.

The findings from the Neutrosophical Logic Model study are of interest to a variety of application areas, including artificial intelligence, expert systems, risk management, and decision making. In this discussion we will discuss the key aspects of the study, its results and their significance. The Neutrosophical Logic Model provides a powerful tool for accounting for uncertainty and fuzziness in data. The model allows you to effectively work with fuzzy concepts and make decisions under conditions of uncertainty. The study found that the model demonstrates good applicability in various fields such as data analytics, forecasting and risk management. Some aspects of the model may require additional tuning and optimization for specific tasks. In some cases, it is difficult to interpret the simulation results due to ternary logic and data ambiguity. Compared to traditional methods of data analysis and decision making, the neutrosophical logic model demonstrates advantages in accounting for fuzziness and uncertainty. However, the effectiveness of the model may depend on the specific situation and the specifics of the task.

The results of the study have practical significance for the development of intelligent systems that can adapt to uncertainty in data. The neutrosophical logic model can be useful for real-time decision making in various fields where uncertainty and fuzziness need to be taken into account. Overall, the results of the study confirm the potential of the neutrosophical logic model as an effective tool for data analysis and decision making under conditions of uncertainty. Further research in this area may lead to the development of new methods and technologies that can improve the quality of decisions made in various fields of activity.

4. Conclusion. *During the study of the neutrosophical logical model, valuable results were obtained that allow us to draw a number of important conclusions about the applicability and effectiveness of this model. The results of the study showed that the neutrosophical logic model is an effective tool for data analysis and decision making under conditions of uncertainty. The model demonstrates applicability in various fields, including artificial intelligence, expert systems and risk management: The Neutrosophical Logic Model has several advantages, such as accounting for uncertainty and fuzziness in data, the ability to deal with fuzzy concepts and make decisions under uncertainty. Based on the results of the study, we can recommend the use of a neutrosophical logic model for data analysis and decision making in situations where the data is not absolutely accurate or complete. Further research in the field of the neutrosophical logic model may lead to the development of new methods and technologies that can improve the quality of decision making and increase the efficiency of data analysis in various fields. Thus, the results of the study confirm the significance and promise of the neutrosophical logic model as a modern tool for data analysis and decision-making under conditions of uncertainty. Neutrosophical fuzzy models of the Sugeno type have a wide range of applications due to their ability to account for uncertainty and fuzziness in data. Some of the main areas where such models can be used include:*

Neutrosophical fuzzy models can be used to control production processes, optimize operating parameters and predict results under conditions of variable and uncertain factors. In finance, models can be used to analyze market dynamics, predict asset prices, identify risks, and make investment decisions. Neutrosophical fuzzy models can help manage transportation systems by improving traffic, optimizing

routes, and predicting and managing passenger and cargo flows. In the medical field, such models can be used to diagnose diseases based on vague symptoms, predict the risk of developing diseases, and optimize patient treatment. In the energy field, neutrosophical fuzzy models can help in managing energy distribution, optimizing grid operation, and forecasting energy demand and supply. In ecology, such models can be used to analyze ecosystems, predict the environmental impacts of various factors, and optimize resource management strategies. These areas demonstrate only a portion of the potential applications of Sugeno-type neutrosophical fuzzy models. They can effectively analyze and manage complex systems under conditions of uncertainty, making them a valuable tool in the modern world.

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FINITE ELEMENT ANALYSIS OF THE BED OF THE SHEET STAMPING AUTOMATIC MULTIWAY PRESS IN THE NON-CENTRAL LOADING CONDITIONS

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Abstract

The stress-strain state of the bed of the AA821 multi-position press with a force of 200 kN under off-center application of deforming forces was investigated. Experiments were conducted to determine the slide tilt angles and tool displacements caused by deformations of mechanism parts and bed elements, both in static and dynamic conditions. During static testing, the load was applied using hydro-actuators and applied to the extreme positions of the press, while during dynamic testing, the load was uniformly distributed on the dies by seating pre-crushed crushers.

The results obtained using computer simulation were analyzed, showing that the deformation of the table and columns has the greatest influence on the overall deformation balance of the bed.

Keywords: *Sheet stamping automatic multiposition press, bed, tension-deformed condition*

When designing multi-position sheet metal stamping presses, besides ensuring necessary strength, it's crucial to ensure sufficient rigidity. The performance, durability, slider positioning in the guides, accuracy of manufactured products, and tool longevity directly depend on the rigidity of the base component - the bed, where technological forces are concentrated.

During the operation of such machines, uneven distribution of deforming forces is observed across the stamping transitions. This occurs because the total force of all working forces is applied at a certain distance from the axis of symmetry in the XY plane, leading to slider misalignment in three main planes: XY, XZ, ZY. This misalignment results in various undesirable consequences, such as wear of the guides, bending of the connecting rods, displacement and bending of the die, ultimately leading to loss of technological reliability, accelerated tool wear, and inaccuracy of manufactured products.

Various studies, including [1,2,3], have been conducted to analyze the forces acting on the bed during the operation of a crank-open press. These studies indicate that the deformations of the bed are mainly caused by the forces applied to the main journals of the crankshaft, the force applied to the table surface and distributed over the area of the die attachment, as well as the distributed force on the guides from the press slider.

In subsequent studies, such as [4-8], criteria for selecting optimal parameters for the cross-sections of the beds of crank-open presses have been proposed to increase the durability of the used tools and the quality of manufactured products by reducing the bending deformations of the bed pillars and the metal consumption.

The studies [9-10] examine the influence of elastic deformations of components of multi-position sheet metal stamping presses and bed elements on tool displacement, providing recommendations for reducing loads on the main assemblies of the presses and tools. However, further research in this area is necessary.

The aim of this study is to investigate the stress-strain state of the beds of multi-position sheet metal stamping presses under non-uniform loading conditions. To achieve this, experiments were conducted under static and dynamic conditions to determine the slide tilt angles and tool displacements resulting from deformations of the crank-slider mechanism components and bed elements. Figure 1 illustrates the layout diagram of measurement points and deformations in the bed of the AA821 press.

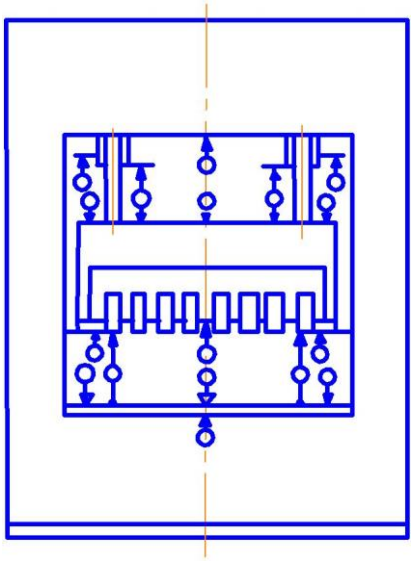

Figure 1. Diagram of deformation measurements in the bed of the AA821 press with a force of 200 kN

During the static deformation study, the load was generated using hydro-actuators and applied to the extreme positions (under the dies), with its magnitude corresponding to the maximum reactions determined from the force graph [11] for an optimal technological process. Monitoring of forces during the tests was conducted using a Class 1.0 pressure gauge.

During the dynamic deformation study of the AA821 press, the nominal load was evenly distributed among two outer and two inner dies, while for the A6126B press, it was distributed among three left and three right positions by applying pre-crushed crushers with varying forces. [10].

To determine the linear deformations of the crank-slider mechanism components, measurements of displacements at various points were performed using clock-type indicators, while the slider displacements were tracked using a hodograph. Holders for the indicators were fixed on a special stand, and for measuring contact deformations at joints, indicator stands with magnetic bases were used.

Table 1 presents the deformation balance measured with indicators at the outer dies (support lines of the crankshafts and in the middle of the fifth position for three crank-slider mechanisms during static loading). Dependencies between the components of the crank-slider mechanism were identified..

Deformations of the bed at the support lines of the crankshafts (outer positions) constitute 0.57 to 0.68 of the deformation at the center of the table (position 5). The greatest contribution to the overall deformation balance of the bed is from the deformation of the table, approximately 77% to 81%, with a deflection of approximately 43% to 33%. The portion contributed by the columns is approximately 10% to 14%, while the portion contributed by the traverse is 8% to 11%.

In the overall deformation balance of the press, the bed accounts for 25% to 40%. However, for the AA821 press, due to insufficient rigidity of the table, the bed deformation (δ_{bed}) constitutes 63% of the total deformation.

From Table 1, it can be observed that the deflection of the slider accounts for 32% to 45% of the total deformation of the crank-slider mechanism components. The deformations of the crank-slider mechanism components (connecting rod, upper head of the connecting rod, shaft support) constitute up to 30% of the overall deformation balance of the slider assembly, while for the A6126B press, they make up 52%. The deformation of the connecting rod-slider assembly components (junction of the connecting rod with the slider) is relatively small, up to 17% (3% for AA821).

The cumulative deformation of the components between the slider and the crankshaft, excluding the deformation of the die (tool), accounts for 31% for the AA821 press and 68% for the A6126B press of the total crank-slider mechanism (CSM) deformation (δ_{CSM}). The deformation attributed to the tool amounts to 30% to 35% of the total CSM deformation (δ_{CSM}) according to [10]. Overall, the CSM deformation constitutes 35% for the AA821 press and 68% for the A6126B press..

Therefore, in the development of presses, primary attention should be given to strengthening the components of the crank-slider mechanism, tooling, and slider. To analyze the stress-strain state of the bed of the AA821 press under a force of 200 kN, a numerical method based on the finite element theory was applied, implemented in the APM WinMachine program. The construction of the finite element

model for the slider was carried out using three-dimensional volume elements CTETRA (four-node tetrahedra).

During the calculation, it is assumed that the bed is subjected to vertically directed forces corresponding to the values of technological operations as fractions of the nominal force [11], while the load on the table is uniformly distributed over the depth of the table within the range of 0.3-0.5. The calculations do not take into account the effect of small convexities and holes, as well as minor changes in section thickness. Due to the high stiffness of the foundation compared to the bed material, the influence of the foundation resistance can be neglected. The bed material is considered isotropic.

On Figure 2, the schematic diagram of the press bed is depicted.

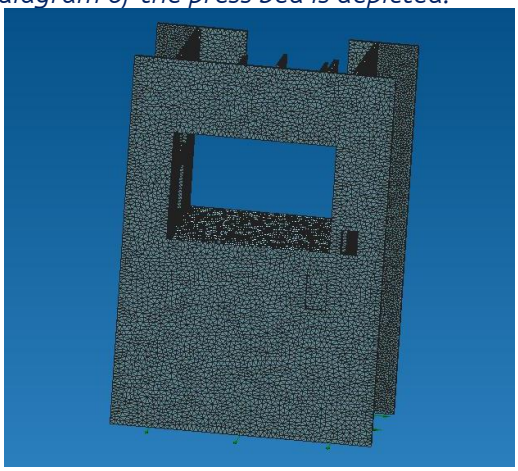

Figure 2. Schematic diagram of the sheet metal stamping press bed.

The results of the stress-strain analysis of the press bed are illustrated in Figures 3-6.

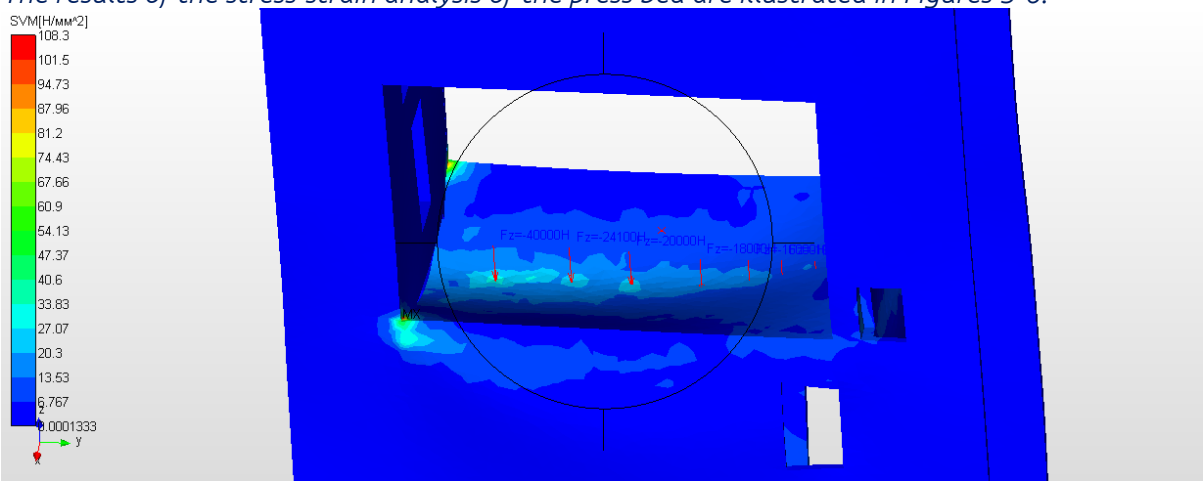

Figure 3. Stress distribution map.

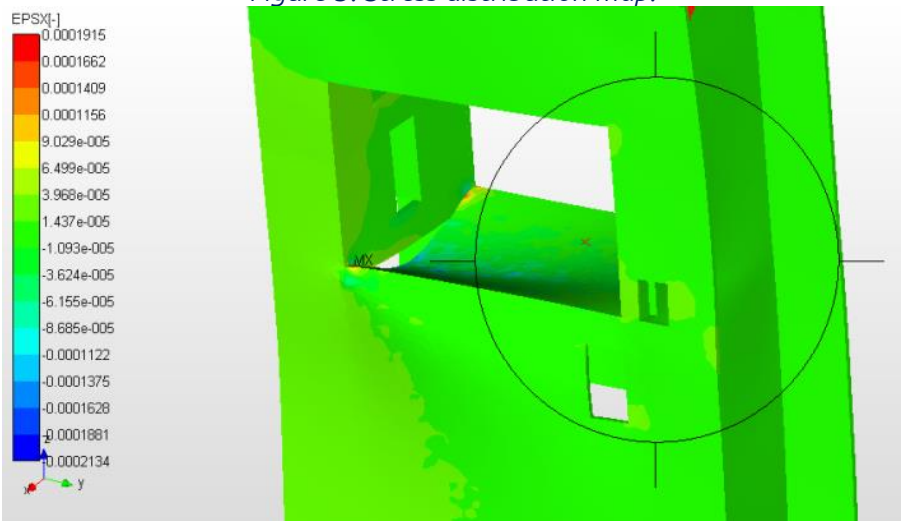

Figure 4. Deformation distribution map.

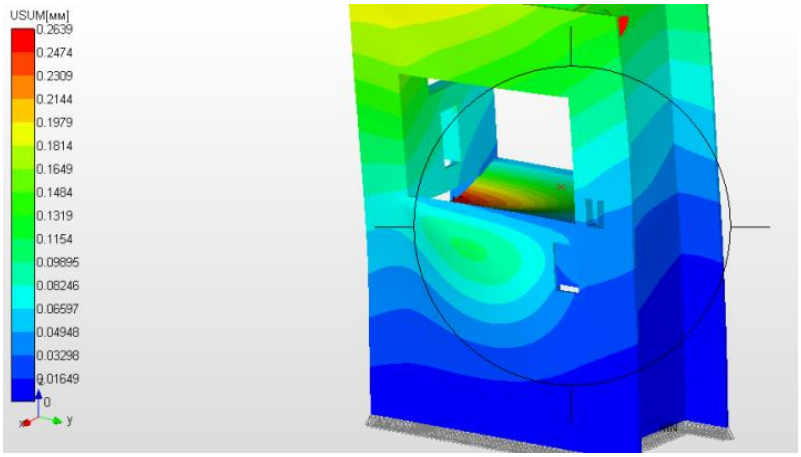

Figure 5. Displacement distribution map.

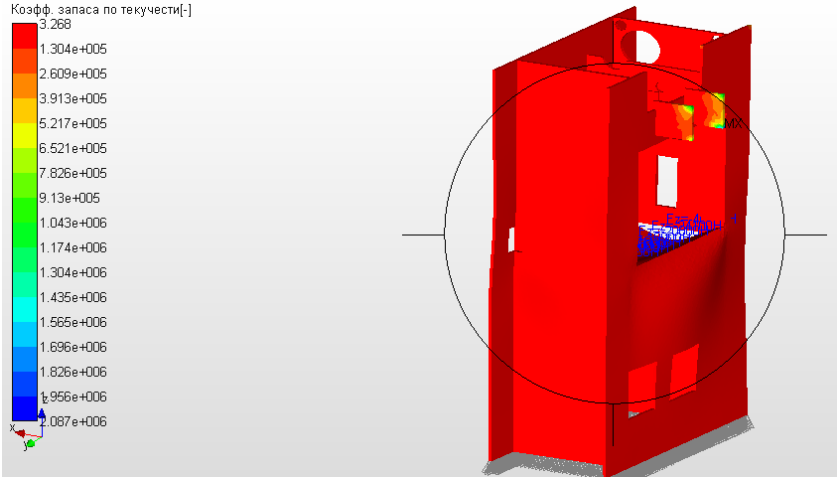

Figure 6. Safety factor coefficient.

The obtained data allows us to draw the following conclusions:

Maximum values of stress (108.3 MPa) and deformation (0.0001915) are observed in the table and the right column of the bed, corresponding to the locations where the cumulative technological forces are applied, consistent with the results of experimental studies (Table 1). The maximum displacement of the table, equal to 0.26 mm, occurs in the table of the press at the right column.

The safety factor coefficient based on the yield strength is 3.268, which exceeds the allowable coefficient for steel structures (ranging from 2.5 to 3), indicating the need for reinforcement of the bed structure.

Conclusions:

To reduce deformations in the table and columns of the press bed, it is necessary to optimize the technological process to minimize the eccentricity of the applied resultant technological load. This will increase the durability of the used tooling and improve the quality of manufactured products by reducing the bending deformations of the bed columns and metal consumption.

The results obtained from the modeling to determine the strength of the press bed can be utilized in the development and improvement of similar automatic presses.

Table 1. Balance of experimental deformations of bed elements at position 5

The press model	Force, kN	Table				Column				Crossbeam		Total deformation of the press bed		Deformation of the press $\delta_{à}$, mm
		Deflection between positions 1 and 8 $\delta'_{ñòë}$ mm	$\frac{\delta'_{còë}}{\delta_{ñòí}}$, %	Total deformation of the table	$\frac{\delta_{còë}}{\delta_{ñòí}}$, %	Deformation of the left column $\delta^{ë}_{ñòê}$, mm	Deformation of the right column $\delta^{ïð}_{ñòê}$, mm	Average deformation of the columns $\delta^{ñð}_{ñòê}$	$\frac{\delta^{ñð}_{ñòê}}{\delta_{ñòí}}$, %	Deformation of the crossbeam $\delta_{òð}$	$\frac{\delta_{òð}}{\delta_{ñòí}}$, %	$\delta_{ñòí}$ mm	$\frac{\delta_{ñòí}}{\delta_{à}}$ mm	
AA82I	200	0,3	43,0	0,54	77,2	0,1	0,1	0,1	14,3	0,06	8,6	0,7 (0,4)	66,0 (66,7)	1,06 (0,6)
A6126Б	400	0,12	32,5	0,3	81,2	0,04	0,03	0,035	9,5	0,04	10,8	0,37 (0,25)	31,9 (31,6)	1,16 (0,79)

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MEMORY DUMPS AS A KEY TOOL IN MALWARE RESEARCH

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ДАМПЫ ПАМЯТИ КАК КЛЮЧЕВОЙ ИНСТРУМЕНТ В ИССЛЕДОВАНИИВРЕДОНОСНОГО КОДА

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Abstract

This paper discusses the role of memory dumps in malware research. Memory dumps are snapshots of RAM containing important information about the current state of a programme or system. In the context of malware research, memory dumps can contain valuable data such as loaded modules, hashes, encryption keys, IP addresses, and other traces of malware activity.

Аннотация

В данной статье рассматривается роль дампов памяти в исследовании вредоносного кода. Дампы памяти представляют собой снимки оперативной памяти, содержащие важную информацию о текущем состоянии программы или системы. В контексте исследования вредоносного кода дампы памяти могут содержать ценные данные, такие как загруженные модули, хэши, ключи шифрования, IP-адреса и другие следы деятельности вредоносной программы.

Keywords: *memory dumps, malicious code, research, analysis, detection, memory, RAM, research, information security*

Ключевые слова: *дампы памяти, вредоносный код, исследование, анализ, обнаружение, память, оперативная память, исследования, информационная безопасность*

Вредоносный код представляет собой серьезную угрозу безопасности компьютерных систем. Он может использоваться для получения несанкционированногодоступа к данным, для распространения спама, для проведения атак на сетевые ресурсы и для других целей. Для обнаружения и анализа вредоносного кода исследователи используют различные методы и инструменты. Одним из наиболее эффективных методов является анализ дампов памяти [1].

Дампы памяти — это файлы, содержащие данные, которые были в памяти компьютера в определенный момент времени. Дампы памяти могут использоваться для обнаружения и анализа вредоносного кода, а также для получения информации о его функционировании. Дамп памяти представляет собой бинарный файл, содержащий копию текущего состояния оперативной памяти компьютерной системы. Этот файл захватывает важные данные, такие как активные процессы, загруженные динамические библиотеки, переменные окружения и содержимое регистров процессора [1]. В контексте исследования вредоносного кода дамп памяти может быть снят в момент обнаружения подозрительной активности или после инцидента, предоставляя исследователям ценные сведения о том, как вредоносное ПО взаимодействует с системой [2].

Создание дампа памяти – процесс, который играет критическую роль в исследованиях в области информационной безопасности, анализе вредоносного кода и решении инцидентов. Этот процесс позволяет сохранить текущее состояние оперативной памяти системы в бинарном файле, что дает исследователям уникальный материал для дальнейшего анализа. Существует множество инструментов для создания дампов памяти, и выбор зависит от операционной системы и конкретных требований исследования [3]. Некоторые популярные инструменты включают FTK Imager, Belkasoft и др.

Для анализа дампов памяти используются такие программы как Volatility и WinDbg, они предоставляют исследователям мощные средства для анализа структуры памяти, извлечения данных о процессах и поиска следов вредоносной активности [7]. Эти инструменты также поддерживают анализ дампов различных операционных систем, что делает их универсальными для использования в различных сценариях.

Одним из способов обнаружения вредоносного кода в дампах памяти является поиск известных сигнатур. Сигнатура — это уникальный набор данных, который используется для идентификации вредоносного кода. Сигнатуры вредоносного кода могут быть получены из различных источников, например, от антивирусных компаний, от производителей программного обеспечения или от других исследователей [5].

Исследователи могут использовать дампы памяти для восстановления данных, удаленных вредоносным кодом, а также для воссоздания последовательности событий, приведших к инциденту. Этот процесс включает в себя анализ областей памяти, связанных с деятельностью вредоносных программ, и восстановление структуры данных, которые могли быть изменены или скрыты.

Дампы памяти также могут служить инструментом проактивного анализа безопасности. Собирая данные в режиме реального времени или регулярно создавая дампы памяти, организации могут обнаруживать подозрительную активность до того, как она приведет к серьезному инциденту. Это позволяет усилить меры безопасности и предотвращать атаки, основываясь на анализе динамической активности системы [4].

Для поиска сигнатур вредоносного кода в дампах памяти используются специальные инструменты, называемые сигнатурными детекторами. Эти инструменты сканируют дампы памяти на наличие известных сигнатур. Если сигнатура вредоносногокода обнаружена в дампе памяти, то это означает, что в системе присутствует вредоносное ПО [8].

Помимо обнаружения вредоносного кода, дампы памяти могут использоваться для его анализа. Анализ вредоносного кода позволяет исследователям получить информацию о его структуре, о его функциональности и о его целях.

Для анализа вредоносного кода в дампах памяти используются различные инструменты и методы. Одним из наиболее популярных методов является декомпиляция. Декомпиляция — это процесс обратного преобразования исполняемого кода, такого как машинный код, обратно в исходный код на языке программирования. Этот процесс может быть полезен в ситуациях, когда у вас есть исполняемый файл, но нет доступа к исходному коду, например, при анализе программного обеспечения для обнаружения уязвимостей или восстановления утерянного исходного кода. Декомпиляция может быть сложной задачей из-за потери информации в процессе компиляции и оптимизаций, которые могли быть применены к исходному коду.

Другим методом анализа вредоносного кода в дампах памяти является статический анализ. Статический анализ — это процесс анализа кода без его выполнения. Статический анализ позволяет исследователям обнаружить потенциальныеуязвимости в коде, а также получить информацию о его структуре и функциональности[3].

Основные статические методики:

- *Сканирование антивирусом*
- *Хеширование и анализ*
- *Поиск строк*
- *Поиск импортированных и экспортированных функции*
- *Поиск по сигнатурам*

Динамический анализ выполняется после запуска вредоносной программы. Это второй этап исследования вредоносного кода, и его обычно проводят после того, как базовый статический анализ зашел в тупик — либо из-за обфускации/упаковки, либо ввиду исчерпания имеющихся статических методик [3].

Основные динамические методики:

- *Песочницы*
- *Запуск вредоносных программ в тестовой среде*
- *Просмотр процессов после запуска*
- *Procmon*
- *Мониторинг сети*

- *Обратное проектирование*

Анализ дампов памяти может быть использован для получения информациио следующих аспектах вредоносного кода:

- *Название вредоносного ПО*
- *Версия вредоносного ПО*
- *Автор вредоносного ПО*
- *Цели вредоносного ПО*
- *Функциональность вредоносного ПО*
- *Способы распространения вредоносного ПО*

Получение информации о вредоносномкоде из дампов памяти может быть использовано для разработки эффективных методов защиты от него.

Дампы памяти содержат информацию о сетевом взаимодействии процессов. Это включает в себя сетевые соединения, сессии, и передаваемые данные. Анализ этих данных позволяет выявлять аномалии в сетевом взаимодействии, что может свидетельствовать о деятельности вредоносного кода.

Исследователи могут использовать дампы памяти в качестве отправной точки для дальнейших исследований. Детальный анализ содержимого дампа может выявить конкретные характеристики вредоносного кода, что станет основой для создания более эффективных сигнатур и правил обнаружения [6].

Дампы памяти являются важным инструментом в исследовании вредоносного кода. Они могут использоваться для обнаружения, анализа и получения информации о вредоносном ПО. Анализ дампов памяти позволяет исследователям лучше понять угрозу, которую представляет вредоносное ПО, и разработать эффективные методы защиты от него.

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BLACK ELDERBERRY AS A BASE FOR MARSHMALLOWS

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Abstract

In order to improve the range and nutritional value of food products, it is necessary to enrich them with natural, biologically active substances using the fruits and berries from local raw material resources, as they are a source of natural biologically active substances, which they contain in easily digestible form and optimal for the human body. In this regard, the development of marshmallow technology enriched with biologically active substances for therapeutic-prophylactic and functional purposes is very important. We used the black elderberry puree for enrichment. The obtained results confirm that marshmallow, in the recipe of which 30% of the apple puree was replaced by the black elderberry was characterized by the best organoleptic and physical-chemical parameters, it also has a longer shelf life.

Keywords: *black elderberry puree, marshmallow, organoleptic and physical-chemical parameters.*

In recent years, it has become increasingly relevant and recommended by scientists to study the wild-growing fruit-berry raw materials, which in addition to being distinguished by high yield, durability, rich chemical composition, have pleasant taste, curative-prophylactic action and other useful economic properties. In this regard, our attention was drawn to the widely distributed wild berry plant - black elderberry (Sambucus nigra L.), whose rich chemical composition allows us to consider whether it can be used in the production of functional food products. Although the fruit of the black elderberry has long been used in food, and as a medicinal plant it was known even in the Middle Ages, as a culture it remained neglected. Its berries contain vitamin C (up to 50 mg per 100 g), vitamin P, vitamin B6, carotene, anthocyanins, tannins, carboxylic acids and amino acids ***[3; 6; 7; 8; 9]****. Of the macronutrients, there are present potassium, magnesium and iron* ***[2; 3; 4; 5]****.*

The aim of the work *was to develop a new range of technology and recipe for functional-purpose marshmallow using the black elderberry fruits, for which:*

1) the possibility of adding the black elderberry to the marshmallow recipe was studied in order to expand the range of marshmallow;

2) the form of introduction and optimal dosage of the black elderberry to be added to marshmallow were determined;

3) the recipe and technology for a new range of marshmallow were developed;

4) organoleptic and physical-chemical indicators of the quality of the new type of food product were determined;

5) microbiological indicators of the developed food product were studied in order to determine its shelf life.

We chose agar-based marshmallow "Vanillin" as a reference sample ***[12]****.*

We aimed in this recipe to replace a portion of apple puree with the black elderberry, for which we needed to establish the form of introducing the black elderberry fruit and its optimal dosage.

Since the apple puree is used in the reference recipe, in order to better diffuse them by mixing them together and obtaining a homogeneous mass, we introduced the black elderberry in the form of puree. To determine the optimal dosage, we prepared experimental samples of marshmallow from the mass obtained according to the marshmallow production technology, where the amount of the black elderberry puree varied from 15 to 45% compared to the amount of apple puree. The amount of puree to be added was determined by taking into account the dry matter content therein.

We studied physical-chemical and organoleptic indicators of the quality of all samples of marshmallow produced using the black elderberry puree (Table 1).

Table 1.

Quality indicators of marshmallows prepared using elderberry puree

Indicator	Control samples	Test samples with the addition of elderberry puree		
		15 %	30 %	45 %
physical-chemical indicators				
Mass part of moisture, %	17,8	18,5	18,9	19,3
Density, g/cm^3	0,45	0,52	0,56	0,58
Acidity, acidity number	3,7	3,6	3,5	3,4
Mass part of reducing substances, %	10,5	10,3	10,0	9,7
Mass part of ash, insoluble in 10% solution of hydrochloric acid, %	0,045	0,042	0,044	0,047
Organoleptic indicators				
Taste and smell	Typical for this assortment	Slightly pronounced taste of elderberry	Pleasant taste of elderberry	Pronounced taste of elderberry
Color	White with a beige tint	White with a pink tint	Pink	With a purple-bluish tint
Consistency	Soft, fluffy	Soft, fluffy	Soft, fluffy	Soft, slightly stretchy
Structure	Homogeneous, finely porous	Homogeneous, finely porous	Homogeneous, finely porous	Unequal
Shape	Typical for this assortment	Typical for this assortment	Typical for this assortment	Does not match the specified range
surface condition	Uniform, without coarse hardening on the sides	Uniform, without coarse hardening on the sides	Uniform, without coarse hardening on the sides	Unequal

It was found that with increasing the amount of the black elderberry puree, the density of the product increases from 0.45 to 0.58 g/cm^3. The best of all indicators was the sample 2, in which the amount of the black elderberry puree was 30% of the apple puree prescribed by the marshmallow reference sample.

One of the important indicators of the quality of marshmallow is its acidity, so we studied the effect of the amount of the black elderberry puree on changing the acidity of marshmallow.

As a result, the acidity value is optimal (3.5 acidity number) when 30% of the black elderberry puree is added.

To study the quality of marshmallow made with the addition of the black elderberry puree, during the storage process, samples were packed in polyethylene material and stored for 30 days at 18-20 ^{0}C and 75 % relative humidity. The rate of moisture loss was reduced in all samples. The rest of the quality indicators remained within the requirements of the standard.

Thus, the optimal dosage of the black elderberry puree is 30%. The content of functional ingredients - vitamins, dietary fiber, pectin, macro- and micronutrients in the black elderberry puree predetermines the high nutritional and biological values and functional properties of a new range of marshmallow.

The study of organoleptic indicators of the product revealed that the test sample in which 30% of the apple puree was replaced by the black elderberry puree, has the best organoleptic indicators, particularly taste and smell, color, consistency, structure, shape and the surface condition indicating that 30% of the black elderberry puree may be considered to be an optimal amount (Fig. 1).

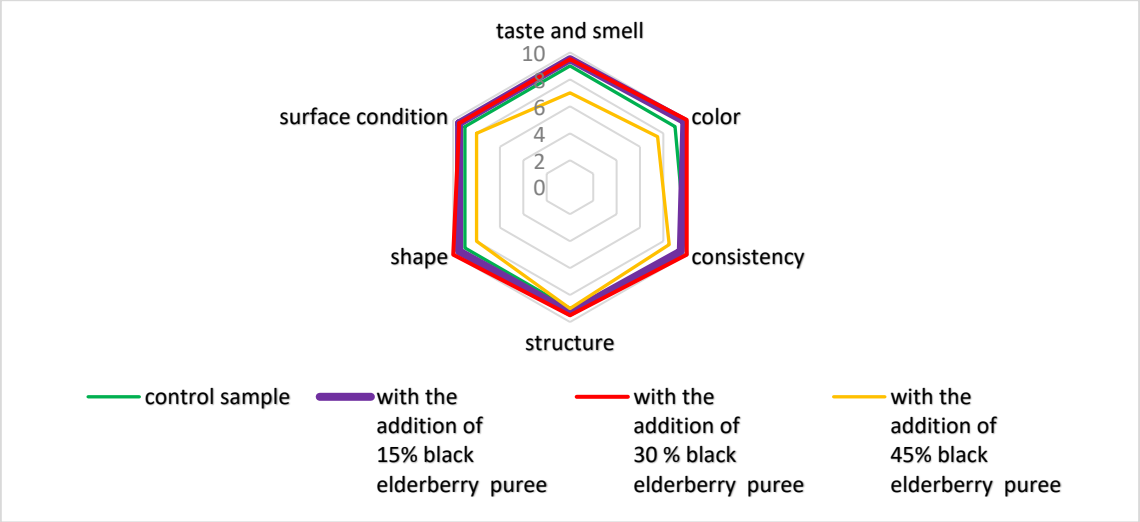

Fig. 1 Organoleptic indicators of control and test samples of marshmallow

We have studied the microbiological characteristics of the new product - marshmallow "Didgula".

The number of mesophilic-aerobic and facultative-anaerobic microorganisms in the test samples varied in the range of 1.6 • 102 to 2.4 • 102 CFU/g (colony forming unit /g), which does not exceed the value established by sanitary norms and rules, coliform bacterium group was not found in a sample of 0.01 g and met the hygienic requirements of microbiological safety, while pathogenic microorganisms, including salmonella, were not detected in the sample of 25 g, which also meets the standards of microbiological safety and indicates the safety of the product.

At the next stage of the work, we determined the changes in the microbiological parameters of the test samples during the storage process by adding different amounts (15, 30 and 45%) of the black elderberry puree after 10, 20 and 30 days (Figure 2).

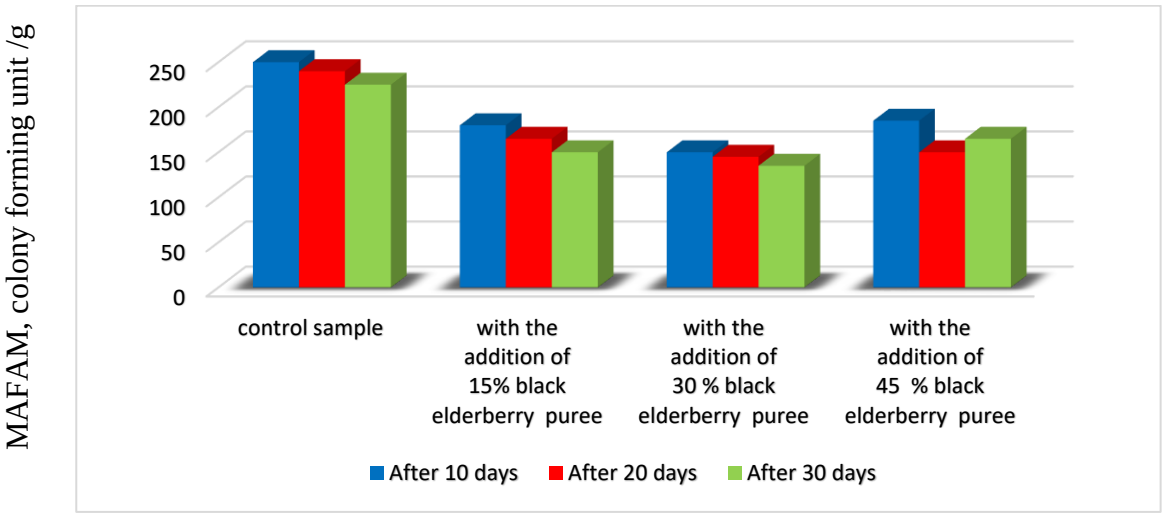

Fig. 2 Changes in mesophilic-aerobic and facultative-anaerobic microorganisms of the control and test samples of marshmallow during the storage process

It has been established that no coliform bacteria and salmonella were found in the test samples during the storage period, and the dynamics of changes in mesophilic-aerobic and facultative-anaerobic microorganisms showed that in all cases its magnitude was reduced to a minimum of 30% per year.

Besides, the addition of the black elderberry puree has increased the shelf life, which can be explained by a high content of antioxidant substances, in particular, ascorbic acid, pectin and tannins.

The combination of the obtained data shows that the use of black elderberry puree in the production of marshmallow has a positive effect on the organoleptic and physical-chemical parameters of the product, enriching it with a number of nutrients useful for the body and imparting functional and prophylactic properties.

Based on the results of the experiment we can conclude that:

1. The form of introducing and optimal dosage of the black elderberry fruit in the marshmallow recipe was determined - the black elderberry was introduced in the form of puree for better diffusion and homogeneous mass, and as for the dosage, it turned out that marshmallow, in the recipe of which 30% of the apple puree was replaced by the black elderberry was characterized by the best organoleptic and physic-chemical parameters;

2. It has been found that the addition of 30% the black elderberry puree to marshmallow increases the shelf life of the product, which can be explained by the increase in the content of antioxidant substances, in particular, ascorbic acid, pectin and tannins.

3. Microbiological indicators of the developed product indicate its sanitary safety.

4. The combination of the obtained results indicates the expediency of using black elderberry in production of marshmallow.

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INTEGRATION OF RENEWABLE ENERGY SOURCES IN GAS CONSUMPTION CONTROL

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Abstract

The integration of renewable energy sources into traditional gas consumption systems has emerged as a promising solution to address both energy security and environmental sustainability challenges. With the increasing focus on reducing greenhouse gas emissions and transitioning towards a low-carbon future, leveraging renewables in conjunction with gas consumption offers a pathway to achieve these goals.

Introduction

Renewable energy is the most promising solution to the rising problem of greenhouse gas emissions, and it also contributes to environmental protection. [3; 251]

The use of sustainable energy systems is being adopted by governments for reasons such as ever-increasing climate change issues, concerns about the security of energy supply, and increasing energy consumption. The ratio of green production to installed capacity is increasing day by day. As a result, modern energy systems are undergoing major changes.

Due to the increasing integration of renewable energy sources into the production complex, some steps should be taken to maximize the development of the gas sector. One of the main steps is the integration of the gas industry into renewable energy sources.

Drawing. 1. Obtaining consumer gas at the expense of renewable energy sources.

Gas is poised to play a pivotal role in combating climate change, particularly through the utilization of 'green' or 'blue' gas that has undergone substantial decarbonization. This shift emphasizes the importance of advancements in carbon capture and storage (CCS) technologies, alongside the adaptation of infrastructure to accommodate emerging fuels like hydrogen. Rather than relying solely on natural gas for power generation or petrochemical production, the focus is shifting towards sustainable gas options that contribute significantly to reducing greenhouse gas emissions. This transition underscores the necessity for innovation and investment in cleaner energy solutions to mitigate the impacts of climate change effectively. [4; 3]

Contents of the study

Integrating renewable energy sources into gas consumption offers a number of advantages for the country and social welfare by reducing environmental pollution and dependence on exhaustible energies. Integrating renewable energy sources such as solar, wind, and hydroelectric power with gas consumption

can significantly reduce carbon emissions. Renewables produce electricity with minimal or no greenhouse gas emissions, thereby lowering the carbon intensity of energy generation.

Diversifying the energy mix through the integration of renewables reduces dependence on fossil fuels, thereby enhancing energy security. Unlike finite fossil fuel resources, renewable energy sources are abundant and widely distributed, mitigating the risks associated with supply disruptions. [2; 1274]

Renewable energy costs have declined significantly in recent years, making them increasingly competitive with conventional energy sources. Integrating renewables with gas consumption can lead to cost savings over the long term, especially as technological advancements continue to drive down renewable energy costs.

Combining renewables with gas consumption can create a more resilient energy infrastructure. Renewable energy sources are often decentralized and distributed, reducing the vulnerability of the energy system to disruptions such as extreme weather events or cyber-attacks.

Although the integration of renewable energy sources into gas consumption reduces environmental pollution and dependence on exhaustible energies at every point, there will be some problems for the development and creation of these systems. One of the primary challenges of integrating renewables with gas consumption is their intermittent nature. Solar and wind power generation fluctuates with weather conditions, requiring complementary gas-fired power generation to provide reliable backup power when renewable output is low.

Integrating renewable energy sources into existing gas consumption infrastructure requires upgrades and investments in grid infrastructure. Ensuring seamless integration and grid stability necessitates advanced grid management technologies and regulatory frameworks.

Deploying energy storage technologies such as batteries can help address the intermittency of renewables and improve system flexibility. However, storage technologies still face challenges related to cost, efficiency, and scalability, which need to be overcome for widespread adoption.

Several countries are actively integrating renewable energy sources into their gas consumption infrastructure. This integration is primarily aimed at reducing greenhouse gas emissions and transitioning towards more sustainable energy systems. Some of the countries leading in this effort include:

Germany has been at the forefront of renewable energy integration for years, including in its gas consumption. The country is investing in technologies such as power-to-gas, where excess renewable electricity is used to produce hydrogen or synthetic natural gas, which can then be stored or used in existing gas infrastructure.

The Netherlands is exploring various ways to integrate renewable energy into its gas consumption. This includes projects like blending hydrogen into the natural gas grid and developing offshore wind farms that can produce green hydrogen.

Denmark is another leader in renewable energy integration. The country has significant experience in using biogas, produced from organic waste, as a renewable source of gas for heating and transportation.

The UK has been investing in renewable energy sources like wind and solar, as well as exploring options for integrating hydrogen into its gas grid. Projects such as the H21 North of England plan aim to convert the existing natural gas grid to hydrogen.

In the US, several states and regions are integrating renewable energy into gas consumption. This includes initiatives such as using biogas from landfills and anaerobic digesters, as well as exploring the potential of renewable natural gas produced from sources like agricultural waste.

Australia is increasingly looking towards renewable energy sources to supplement its gas consumption. This includes projects like injecting hydrogen into the gas network and exploring the use of biogas from waste streams.

These countries are actively working on integrating renewable energy sources into their gas consumption infrastructure as part of their broader efforts to transition to cleaner and more sustainable energy systems.

In the mentioned countries, we can see the integration process in different variants. All of these options can be applied in a general form to the complex integration process. It is true that the alternative energy reserves of some countries vary depending on their geographical location, but for the development of a better system, it is important to carry out a SWOT analysis of this process.

Result

By ensuring the integration of renewable energy sources into gas consumption, a number of positive results can be achieved, the most important of which are as follows:

• *Hybrid energy systems that combine renewable energy sources with gas-fired generation offer a flexible and reliable approach to meeting energy demand. These systems can optimize the use of renewables while ensuring grid stability and reliability. [1; 3174]*

• *Integrating renewable energy sources with gas consumption across multiple sectors, including power generation, transportation, heating, and industrial processes, presents opportunities for synergies and efficiency gains. Sector coupling can facilitate the decarbonization of various sectors and accelerate the transition to a sustainable energy system.*

• *Continued technological innovation in renewable energy, gas-fired generation, and energy storage holds the key to overcoming existing challenges and unlocking new opportunities for integration. Advancements in smart grid technologies, digitalization, and energy management systems can further enhance the efficiency and reliability of integrated energy systems.*

The integration of renewable energy sources into gas consumption represents a critical strategy for achieving a sustainable, low-carbon energy future. By leveraging the complementary strengths of renewables and gas-fired generation, countries can reduce carbon emissions, enhance energy security, and foster economic growth. Addressing challenges such as intermittency, grid integration, and policy support is essential to realizing the full potential of integrated energy systems. With concerted efforts from policymakers, industry stakeholders, and technology innovators, the transition towards integrated renewable and gas-based energy systems can accelerate, paving the way for a cleaner and more resilient energy future.

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