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ECOLOGICAL, ECONOMIC AND FINANCIAL TRANSFORMATION OF UKRAINE IN COOPERATION WITH THE EU: CHALLENGES AND PROSPECTS

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ECOLOGICAL, ECONOMIC AND FINANCIAL TRANSFORMATION OF UKRAINE IN COOPERATION WITH THE EU: CHALLENGES AND PROSPECTS

Within the framework of a project EU Erasmus +:
"Reformatting the environmental, energy, economic and financial spheres of Ukraine in the European integration conditions",
№ 101085182 - REEEFSUEIC

Monograph

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Ecological, economic and financial transformation of Ukraine in cooperation with the EU: challenges and prospects

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The joint monograph is dedicated to the pressing issues of transformational processes in the ecological, economic, and financial spheres. The goal of the monograph is to investigate and analyze significant aspects of ecological, economic, and financial transformations in Ukraine in the context of cooperation with the European Union. The monograph aims to study the challenges faced by Ukraine in the fields of ecology, economics, and finance, as well as to identify prospects and opportunities for the country's further development.

To achieve the goals and objectives of the monograph, the following research methods are employed: a systemic approach, a historical approach concerning historical aspects of ecology, economics, and finance in Ukrainian and European economies; an analysis and synthesis method for summarizing scientific methods of economic efficiency; a statistical method and modeling method for developing schemes, diagrams, and appendices; a generalization method for developing fundamentals and observing the main research directions; a scientific abstraction method of economic-mathematical modeling and econometric analysis to identify the main factors influencing the development of ecology, economics, and finance in Ukraine and the EU.

The authors of the monograph have formulated recommendations for analyzing the ecological state of Ukraine and identifying priority directions for ecological transformations; studying the economic aspects of Ukraine's cooperation with the EU, including trade, investments, and economic reforms; researching the financial aspects of Ukraine's development in the context of cooperation with the European Union, including financial support and investments. The monograph is aimed at enriching the scientific knowledge base and understanding the importance of ecological, economic, and financial aspects of Ukraine's development in the context of its cooperation with the EU.

Keywords: reform, environmental, economic, financial sector, EU experience.

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INTRODUCTION

Borrowing European experience in the field of environmental development, ensuring an adequate level of energy security, and implementing transformative changes in the European green economy and finance are becoming relevant issues for the country on its path to European integration.

The study of the best European practices in EU environmental policy based on action programs in environmental protection and environmental directives, European approaches to energy conservation, and European practices of innovative economic and financial system development is a way to address the problems in the ecological, economic, and financial sectors of Ukraine. The research covers the following areas: eurointegration ecological components in the context of air protection in Ukraine; a comparative analysis of the waste management systems in ukraine and the EU; european experience in enhancing financial literacy among the population as a strategy for effective personal finance management; implementation of EU sustainable development goals in the economy of Ukraine; analysis of the payment systems in ukraine in the context of the european vector of energy efficiency.

The monograph "Ecological, economic and financial transformation of Ukraine in cooperation with the EU: challenges and prospects" was prepared by a team of professors from the National University "Yuri Kondratyuk Poltava Polytechnic" as part of the EU Erasmus+ project: "Reformatting the environmental, energy, economic and financial spheres of Ukraine in the European integration conditions" (Project No. 101085182 - REEEFSUEIC). The project aims to popularize the best European practices in EU environmental policy based on action programs in environmental protection and environmental directives, European approaches to energy conservation, and European practices of innovative economic and financial system development.

The monograph focuses on researching and analyzing the current aspects of transformations taking place in Ukraine in the fields of ecology, economics, and finance within the context of its cooperation with the European Union (EU). It addresses the challenges that Ukraine faces in environmental protection, ensuring energy security, and implementing transformative changes in the economic and financial sectors.

EUROPEAN INTEGRATION ENVIRONMENTAL COMPONENTS IN THE CONTEXT OF ATMOSPHERIC AIR PROTECTION IN UKRAINE

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The European Green Course is already a top topic for Ukrainian politicians, mass media, experts, business, the public and their associations for discussions, large-scale plans for the future and risk assessment [1].

The priority is to bring certainty to the tense discourse about the high cost and probable unprofitability of business, in the case of ambitious climate goals; about the indisputability of the transition to renewable energy sources without the use of fossil fuels and the need to achieve, with the establishment of a specific term, climate neutrality directly by the state of Ukraine. Transparent answers to these painful questions can be found in the Conclusions of the European Economic and Social Committee dated October 28, 2020:

- measures to combat climate change should be implemented in such a way as to minimize costs and obtain economic benefits;
- achieving climate neutrality requires increasing carbon absorption and storage through, for example, sustainable management of forests and soils;
- achieving a climate-neutral EU by 2050 means that not every member state has to pursue climate neutrality individually: optimal distribution of efforts can be achieved at the EU level, taking into account relevant differences between member states.

The next, although far from the secondary, and extremely complex issue is the programming of the implementation with the ultimate goal of climate neutrality of the multi-vector European Green Course (providing clean, affordable and safe energy; construction and reconstruction in an energy resource-efficient way; mobilization of the industry for a clean and circular economy; from " farm to fork": the creation of a fair, healthy and ecologically clean food system; acceleration of the transition to sustainable and intelligent (smart) mobility; preservation and restoration of ecosystems and biodiversity; striving for zero pollution of the environment without toxic substances).

As a result of the full-scale invasion of Russia, 90% of wind power and 45-50% of solar power in Ukraine have been decommissioned [2].

Ukraine has great potential for the development of renewable energy, in particular wind energy. And Europe is interested in investing in this direction after the end of the war.

All energy facilities in Ukraine are subject to restoration, but some of them are more expedient to build anew.

Everything is subject to repair and restoration, the only question is timing. Some objects can be restored in a few days, some can be restored in weeks, and some - in months.

After the victory in the war, Ukraine faced serious work to restore critical infrastructure facilities.

Priority steps for communities after the end of hostilities:

1. Assess the damage caused, conduct an audit of negative impacts and engage in an urgent search for possible steps for recovery.

Communities need to understand the magnitude of the work, as it ranges from field mine problems to iron ore. All this affects the natural system and ecology and takes us several steps back. But due to such a negative impact, we will have to put more effort into this direction, it will be at the top next to exports.

Nevertheless, we observe that in regions where farmers are already making the transition to sustainable practices in agriculture, such as the use of minimal tillage, and the same organics, they continue to move in this direction and do not abandon such practices.

This is an important signal to our European colleagues that Ukraine has become a country that is ready to move within the framework of the European Green Course as a partner.

2. Create an effective development plan. Communities should already prepare and think about heating from renewable and independent energy sources, about other aspects of a sustainable regional economy.

The war will only accelerate the process of decentralization, that is, communities are already forced to make many decisions independently at the local level to ensure their functioning [3].

During martial law in Ukraine in the territories where martial law is imposed [4]:

- Land leases are extended automatically for 1 year without entering information into the relevant registers.

- The district military administrations are granted the right to lease for commercial agricultural production for a period of up to 1-year agricultural land plots of state and communal ownership, as well as land plots remaining in the collective ownership of a collective agricultural enterprise, agricultural cooperative, agricultural joint-stock company, unallocated and unclaimed land plots and land shares (shares). At the same time, the amount of rent cannot exceed 8% of the normative monetary value of land plots, and the average normative monetary value of a unit of arable land in the region will be used to determine the amount of rent.

- Strict restrictions are established regarding the intended use of agricultural land plots by tenants to whom the plots will be provided by the district military

administrations, including changes in the composition of the land, transfer of plots to sublease, construction, changes in the purpose of the land plot, etc.

- To quickly transfer land plots to the use of district military administrations, land lease contracts will be concluded only in electronic form, and the transfer of land plots for lease will take place without holding land auctions. Such a one-year land lease agreement cannot be renewed or concluded for a new term, and it will terminate with the expiration of the term for which it was concluded.

- Land lease contracts concluded by the military administration will be registered by the same administration in the Book of Registration of Lease Contracts, which is kept in paper and electronic form, and a copy of the land lease contract will be sent by e-mail to the village, settlement, city council, on the territory of which the land plot is located, and as well as the central body of executive power that implements state policy in the field of land relations.

Speaking about the European Green Course and the environmental tax on CO2 emissions, it should be noted that in the context of the implementation of the Paris Agreement to combat global warming by the Government of Ukraine, draft law No. 5600 provides for a threefold increase in the environmental tax on carbon dioxide (CO2) emissions, namely from UAH 10/ t up to UAH 30/t. Will this be a fiscally viable measure for the budget and climate goals? But how can the environmental tax on CO2 emissions be more effective in Ukraine?

The current tax on CO2 emissions requires improvement of the tax administration to ensure stable revenues to the budget, reduce the costs of fulfilling the tax obligation and effective compliance.

The problem is that, according to the Tax Code of Ukraine, the tax calculation must be based on actual CO2 emissions, and in practice, it is carried out according to a special methodology that is quite complex, based on the amount of resources consumed and the characteristics of the production process, at best. Sometimes enterprises determine their tax obligations "by eye" based on data from the emission permit, which is obtained even before the start of operations. Thus, the results of a comparison of the declared tax base and the amount of CO2 emissions according to the data of the State Statistics Service and the Cadastre of Greenhouse Gas Emissions using the example of ferrous metallurgy indicate that the share of untaxed emissions is 21% and 60%, respectively. That is, the approach to taxation that is currently used based on theory, although it should be the most effective, in practice does not ensure full coverage of carbon dioxide emissions by the tax.

Accordingly, the administration of this tax is characterized by time-consuming tax audits, and the need to involve specialists of nature protection authorities to determine the correctness of the calculation of the tax base. As a result, this leads to the insufficient effectiveness of the functioning of the tax and a decrease in the law-abidingness of taxpayers due to the existence of opportunities

to avoid punishment for violation of tax legislation. In addition, this approach leads to the fact that CO2 emissions, which are generated during the burning of biomass, are also subject to taxation, which is contrary to global practice. Because this energy resource is a carbon-neutral fuel and is not subject to taxation.

Another disadvantage of the domestic practice of taxation of CO2 emissions is that the basis of taxation of the tax is the amount of CO2 emissions into the atmospheric air by stationary sources, reduced by 500 tons according to the results of the tax (reporting) year, and emissions in the transport sector, which make up from 15 to 19%, generally remain untaxed [5].

A tax on actual or measured CO2 emissions, which is used in Ukraine, has also been introduced in Estonia, Spain, Latvia, the Netherlands and Poland. Another approach to taxation of CO2 emissions, which is based on the carbon content of the fuel for all energy resources, is a tax on the consumption of energy resources.

Such a tax as a structural component of CO2 in the fuel excise rate has been introduced in Denmark, Ireland, Luxembourg, Norway, Portugal, Finland, France, and Sweden. A similar approach is used in Iceland, Liechtenstein, the Netherlands, Slovenia, and Switzerland, but the tax is established separately from the excise duty.

As you can see, out of nineteen European countries, the majority chose the approach of taxation of CO2 emissions, which is based on the amount of consumed energy resources. The reasons for this decision were the significant advantages of such a tax, among which it is worth highlighting the simplicity of calculating the tax liability, the smaller number of taxpayers due to the use of the tax agent institute, and the simplification of the process of checking tax returns.

Calculations based on data from the State Statistics Service of Ukraine for 2019 on the use of all types of fuel for all purposes except for use in technological processes proved that income from stationary sources can be doubled at an emission price of UAH 10/t of CO2. If the price of emissions would be UAH 30 per ton, as proposed in draft law No. 5600, revenues could be 6.3 times higher. Similar calculations based on the consumption of certain types of energy resources, such as coal, natural gas, gasoline, diesel fuel, fuel oil, and liquefied gas, made it possible to find out that at an emission price of UAH 10/t of CO2, the fiscal effectiveness of the tax can be increased by at least by 70% [5].

In addition, budget revenues for the transport sector will increase due to involvement in fuel taxation. For UAH 10 per ton of CO2, additional revenues will amount to UAH 1,151.7 million, or 0.06% of GDP. In case of a price increase to UAH 30 per ton of CO2, revenue is expected to increase by UAH 5,357.7 million, or 0.17% of GDP.

Under the proposed approach, CO2 emissions resulting from industrial technological processes will not be taxed. However, judging by the cadastre data, such emissions are not taxed even now.

It is necessary to provide for an exemption from paying the tax on the use of biomass since carbon dioxide emissions from burning wood are compensated by absorbed CO2 during the growth of a living tree and are not accounted for in the compilation of National inventories of anthropogenic emissions from sources and absorption by sinks of greenhouse gases. It is also necessary to provide for a zero tax rate or a compensation mechanism for the tax paid on fuel that will be used as a raw material for industrial technological processes, for example in the chemical industry. For this, a mechanism similar to the excise tax on light and heavy distillates used for the production of ethylene can be applied. In particular, such energy resources are taxed at a zero rate, and tax authorities control their intended use. Producers issue a tax invoice for the amount of excise tax calculated on the volume of petroleum products obtained based on the rate, which is defined as the difference between the base and zero excise tax rates. The tax bill is considered repaid in case of documentary confirmation of the purposeful use of light and heavy distillates exclusively as raw materials in the production of ethylene.

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Two years ago, the Cabinet of Ministers of Ukraine Resolution No. 827 of August 14, 2019, "Some Issues of State Monitoring in the Field of Atmospheric Air Protection", approved the Procedure for State Monitoring in the Field of Atmospheric Air Protection.

In addition to radical changes in the approach to atmospheric air monitoring, the Procedure provides that for the implementation of atmospheric air monitoring, a state monitoring program in the field of atmospheric air protection (hereinafter - the Program) is approved for each zone and agglomeration in the form established by the Ministry of Environment.

The program is developed for a period of five years and should include:

- information about air quality management bodies that developed the program;

- information about the network of atmospheric air quality monitoring and atmospheric air monitoring laboratories available in the relevant zone or agglomeration, in particular, the list of observation points, their addresses and geographical coordinates, maps with the layout of observation points, addresses of existing atmospheric air monitoring laboratories, information on the indicators analyzed by atmospheric air monitoring laboratories and applied analysis methods, information on atmospheric air monitoring entities that monitor atmospheric air quality at relevant observation points;

- the list of pollutants assessed at observation points in the relevant zone or agglomeration, the methods used to measure, calculate, forecast or estimate the level of pollutants at observation points and the established assessment regime (data based on which the assessment regime was established);

- information on planned measures to establish observation points and/or improve existing air quality monitoring networks, create and/or improve atmospheric air monitoring laboratories, in particular, a list of observation points planned for installation, their addresses and coordinates, maps with a location scheme observation points, information about atmospheric air monitoring entities planning to establish observation points and/or create atmospheric air monitoring laboratories;

- stages, mechanism and terms of implementation of the planned measures.

To fulfil the specified procedure, the Ministry of Environment has developed a form of the Program, the draft of which can be viewed on the website of the Ministry of Environment.

The specified form, in addition to the specified requirements, provides information on:

- sources of pollution, including emitting enterprises, the number of registered vehicles, the length of roads and the presence of other sources of pollution (airports, ports, MVV, OOUV);

- emissions of pollutants from stationary sources, mobile sources

- data on the certification of equipment, devices and their verification procedures of the network of observation points;

- laboratory-analytical complex in terms of laboratory affiliation, number of employees, list of equipment, analysis methods and data verification procedures;

- information disclosure systems;

- assessment of the spatial distribution of pollutant concentrations in terms of location, pollutant, and assessment methods;

- established assessment mode with a justification of its choice;

- observation points by type of station (background, industrial, transport, mixed), type of measurement, purpose of research (health protection, protection of vegetation), type of territory (urban, suburban, rural);

- mandatory appendices, including maps of the spatial distribution of pollutant concentrations, statistics of the distribution of pollutant concentrations

along roads, and maps with diagrams of observation points.

Monitoring in the field of atmospheric air protection is a component of the state system of environmental monitoring. The procedure for organizing and conducting monitoring in the field of atmospheric air protection is regulated by the Resolution of the Cabinet of Ministers of Ukraine "Some issues of state monitoring in the field of atmospheric air protection" dated August 14, 2019 No. 827.

Based on data and information obtained as a result of atmospheric air monitoring:

- determine the level of atmospheric air pollution in a certain area for a certain period and compliance of the state of atmospheric air with air quality requirements;

- carry out control and assessment of the impact on air quality of measures aimed at limiting emissions of pollutants into the atmospheric air, assessment of the impact of atmospheric air pollution on the surrounding natural environment, health and life of the population.

Atmospheric air monitoring is carried out according to quality indicators:

atmospheric air;

atmospheric precipitation.

Depending on the level of pollutants for all zones and agglomerations, the evaluation regime for each pollutant is established:

upper and lower assessment thresholds;

limit values of pollutants;

other levels of pollutants used to assess atmospheric air quality.

The assessment regime is established by the atmospheric air quality management body of the relevant zone or agglomeration in the state monitoring program in the field of atmospheric air protection, according to the following criteria:

mode of fixed measurements;

mode of combined assessment.

The fixed measurement regime is used when the level of the pollutant exceeds the upper assessment threshold or long-term targets for ozone. Fixed measurements are carried out at fixed points of observation of atmospheric air pollution permanently or by random sampling to determine the level of pollutants.

The mode of combined assessment is used if the level of pollutants is lower than the upper threshold of assessment. Combined assessment is performed by combining fixed measurements and a modelling method or indicative measurements according to data quality objectives.

The result of atmospheric air monitoring is:

- observation data received by subjects of atmospheric air monitoring;

- generalized data on the quality of atmospheric air, relating to a certain period and/or a certain territory;

- assessment of the state of atmospheric air and atmospheric precipitation;

- forecasts of the state of atmospheric air and its changes;
- information on the impact of the levels of pollutants in the atmospheric air on the life and health of the population.

In March 2022, PrJSC "Ukrgrafit" put into operation the first modern post in Zaporizhzhia for automatic monitoring of the level of pollutants in the atmospheric air [7].

Work on the selection of equipment, its purchase and adjustment was started back in 2021 and was planned to be completed in May 2022, since environmental issues are important for the city of Zaporizhia, and we made a decision, despite the military situation in the country, not to turn off the equipment monitoring, and on the contrary, to speed up the completion of all work and put the post into operation.

The monitoring post was installed near a residential high-rise building on the street. Yeniseiskaya, which is located in the western direction from the main production of the enterprise (according to the conclusion of the state sanitary-epidemiological examination on the justification of the size of the sanitary-protective zone of the enterprise).

The gas analytical equipment of the monitoring post is located in a metal container, which is equipped with a climate system to maintain optimal working conditions and does not require the presence of operative personnel in the room.

During the development of the monitoring station, gas analytical devices manufactured by the company Teledyne API, USA, which is one of the world leaders in the production of equipment for continuous stationary environmental monitoring with more than 30 years of experience, were used.

The equipment is certified in Ukraine and also meets the requirements of the US Environmental Protection Agency (EPA), the European Union (EU) and other global regulatory bodies for measuring pollutant criteria.

The T100 gas analyzer determines the content of sulfur dioxide in gases using the principle of UV fluorescence to provide easy, accurate and reliable measurements of low SO2 levels.

Exceptional stability is achieved using an optical shutter to compensate for drift and a reference detector to correct changes in the intensity of the UV lamp.

The T200 gas analyzer determines the content of nitrogen oxides in gases. The device uses the principle of chemiluminescence and provides accurate and reliable measurements of low-level substances for use as an environmental analyzer.

The unique AutoZero function provides stability through constant zero drift correction, and adaptive filtering allows the analyzer to optimize performance under changing conditions.

The T300 gas analyzer measures the low ranges of carbon monoxide by comparing the infrared energy absorbed by the sample with the energy absorbed by the reference gas according to the Beer-Lambert law.

Using a gas filter correlation wheel, a high-energy IR light source is alternately passed through a CO-filled chamber and a CO-free chamber. The light path then passes through the sample cell, which has a folded path of 14 meters. This design provides zero stability and a high signal-to-noise ratio for outstanding sensitivity.

The T640 gas analyzer measures the mass concentration of solid particles (PM) with a size of 2.5 and 10 microns in real-time, using the scattered light spectrometry method.

Every day, the results of the monitoring posts are analyzed and posted on the company's website in a mode that provides free access to them.

In Ukraine, monitoring of atmospheric air is regulated by the following documents: Law "On Atmospheric Air", Law "On Protection of the Natural Environment", Law "On Metrology and Metrological Activity", Law of the Russian Federation No. 391 "On Approval of the Regulation on the State Environmental Monitoring System". However, it should be noted that the latest changes in the field of atmospheric air monitoring in Ukraine are the resolution of the Cabinet of Ministers of Ukraine dated August 14, 2019 No. 827 "Some issues of state monitoring in the field of atmospheric air protection" [8]. According to this resolution, several shortcomings of the current monitoring system are revealed, namely:

- lack of monitoring of suspended substances, including PM2.5 and PM10;
- lack of data on pollution covering the entire territory of the city (agglomerations, according to the resolution), i.e. the available information is relevant only at a point;
- monitoring of atmospheric air pollution at stationary observation posts is carried out a maximum of 4 times a day;
- lack of a system for informing the population about the state of air in the city, especially PM2.5 and PM10 pollution;
- lack of automated air quality analysis systems, monitoring is carried out by sampling method.

The main task of creating a network of public monitoring of the state of atmospheric air pollution in the city is to conduct independent monitoring of air pollution, based on such regulations and guiding documents as Directive 2008/50/EU and the Procedure for State Monitoring in the Field of Air Protection. In contrast to state surveillance, public monitoring will ensure not only informing the population, of their involvement in monitoring, but also increase environmental awareness, and responsibility, and create an additional tool for controlling air pollution.

Atmospheric air monitoring is an integral part of the political development strategies of both individual cities and countries as a whole [9]. A significant part of the research conducted by scientists around the world contributes to the development of the protection of the atmospheric basin of cities, determining the impact of pollution and improving the quality of the surrounding environment [10]. However, it is impossible to achieve a quality result in the ecological field, if we

are talking about an urban habitat, if the public is not involved. Conducting monitoring studies and informing the population about their results is important from the point of view of both scientists and the public [11].

The most widespread issue of atmospheric air monitoring is the use of geoinformation technologies and systems. These systems consist of a hardware complex, a software complex and an information block. However, it is quite justified to include the components of geoinformation technologies and people - developers and users, without whom the existence of the last components as a system is impossible. In this case, a system consisting of five components is formed. Most of the software products [12-13] developed for atmospheric air monitoring, which provide the possibility of visualizing the results of observations, require a large amount of input data. In addition to the exact parameters of emission sources, it is necessary to use a large array of meteorological data, which is not always possible to obtain. There is also a need to create a public information system that is easy and quick to administer, and convenient and understandable to the user. Thus, existing software products [14] are aimed at measuring pollution from certain sources or are unsuitable for fast data manipulation.

So, the following 4 key problems are the causal necessity of creating public monitoring of atmospheric air:

- at the state level – assistance in the implementation of the state monitoring program in the field of atmospheric air protection under the Resolution of the Cabinet of Ministers on the monitoring procedure;
- at the enterprise level – assistance in identifying the impact of emissions from "neighbouring" enterprises of the city;
- at the level of the public – assistance in the availability of affordable and independent monitoring of air quality in the city;
- at the level of science – assistance to scientists and other interested structures in obtaining up-to-date information on atmospheric pollution for further analysis, research and reporting.

For the effective functioning of the public monitoring network, it is necessary to develop rules for conducting public monitoring of the city's atmospheric air pollution with a description of the location of pollution sensors, their operation and basic requirements. Also, the development of a database on the conducted monitoring and the development of a website reflecting the results of public monitoring. Taking into account that if the database contains data on the indicators of the installed sensors (point measurements), then the site for informing the population is a visualization of the control results throughout the city, that is, it will act as a model of the distribution of pollutants in the atmospheric air of the city.

Public monitoring of atmospheric air pollution is a network of sensors for determining the concentration of pollutants in the air basin of cities. The location of pollution measurement points should be fixed, but at the same time, it can be quickly changed following the task of a certain study or analysis. The purpose of creating and implementing a public monitoring network is to conduct an independent assessment of the city's atmospheric air quality, followed by

informing the population about its results. Conducting this type of monitoring is not only aimed at attracting the public and increasing their environmental awareness but also serves as a primary analysis of the state of air pollution to obtain data and provide recommendations on the establishment of additional state monitoring stations for atmospheric air quality in the conditions of the implementation of changes to the procedure for conducting monitoring, as well as operational control for certain tasks.

Considering that public monitoring, as mentioned above, is universal and can be used for different tasks, the requirements for installing surveillance sensors are flexible. To obtain general values of atmospheric air pollution in the city, taking into account industrial, residential, and park zones of the city, as well as suburban areas, the main recommendations for installing sensors are:

- installation in areas that ensure no stagnation of air flows,
- installation at a distance of 1.5, 4, or 6 meters from the ground,
- installation at a distance of 10 meters from a road with heavy traffic (or closer, if it is necessary to determine the impact of traffic on this area),
- in suburban areas to determine the anthropogenic impact of the urban environment.

At the beginning of the experiment of creating a network of public control for the city of Poltava, a grid was created for the further display of data with the size of 7x7 cells (Fig. 1).

Taking into account that each cell contained a significant area of the city's territory, and new sensors, entering the cell where research was already being conducted, would be inconvenient to display and incomprehensible to the target user, the dimensions of the 12x12 cell grid were changed (Fig. 2).

Such a solution allows you to preserve the grid in suburban areas, for further expansion of the public monitoring network and also divides the central territory of the city into smaller cells, which prevents the overlapping of indicators of different sensors. So, the grid consists of 144 cells. Each cell covers an area of 1.65 km2. The total area of the city is 103 km2, so 64 central cells completely cover the territory of the city, taking into account the climatic and architectural features of the city [15].

During the experiment, 9 sensors were installed, covering most of the city. The sensors work in an autonomous continuous mode, but to create a public information network, pollution indicators for the following hours were used: 00:00, 06:00, 12:00, 18:00.

The installed sensors (Fig. 3) measure the pollution of the city's atmospheric air with suspended particles PM2.5 and PM10. The main technical characteristics of the sensors for measuring these pollutants are:

– the principle of measurement is optical, which works according to the principle of scattered light;

– measurement range (PM2.5) – 0–500 μg/m3;

– working temperature range – (–10)…+60 °C;

– measurement accuracy – (±10) μg/m3 in the range of 0–100 μg/m3, ±10% in the range of 100–500 μg/m3;

- working range of humidity - 0-99%.

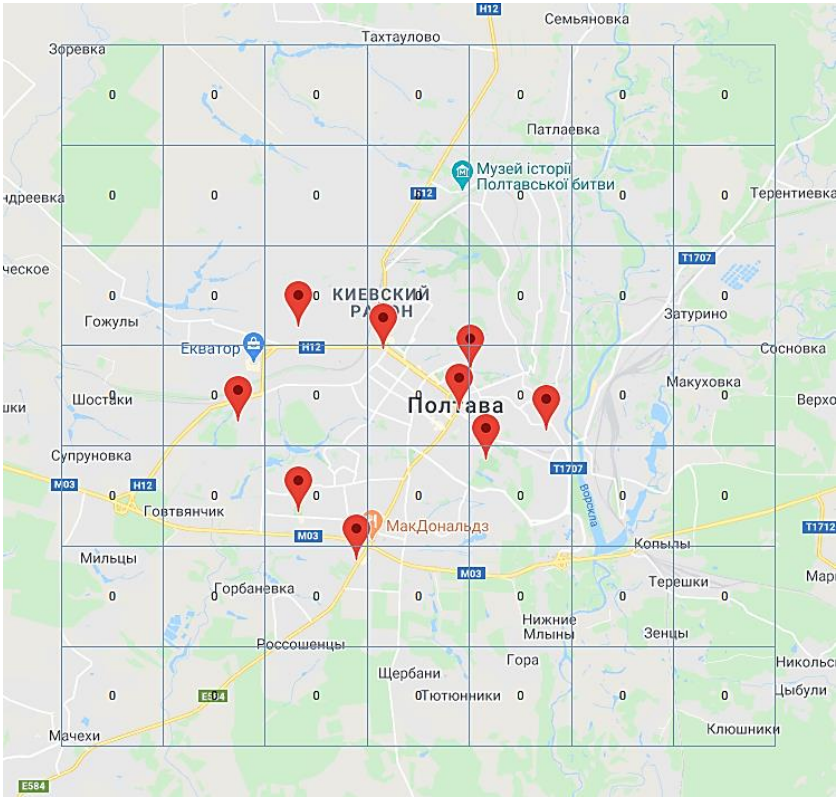

Fig. 1 – The initial view of the public monitoring grid

As a result of the measurements and analysis of the subject area, it was found that there is a need to create a system of visualization of data obtained with the help of an expanded network of public monitoring of the state of atmospheric air (on the example of the city of Poltava). Thus, several shortcomings of the existing information and technical capabilities have been identified, which do not allow displaying the data of the above-mentioned monitoring under the following requirements: the visualization of public monitoring data involves the availability of the results of measurements of the state of the atmospheric air, namely PM2.5 and PM10, from the point of view of breakdown the territory of the city into specific areas and indicating the concentration of dust in these areas. That is, there

is a need to create a system of visualization of the received public monitoring data from the point of view of their planar distribution, and not a display of point measurement, which are currently available public information sites, which are also uninformative or inconvenient to use.

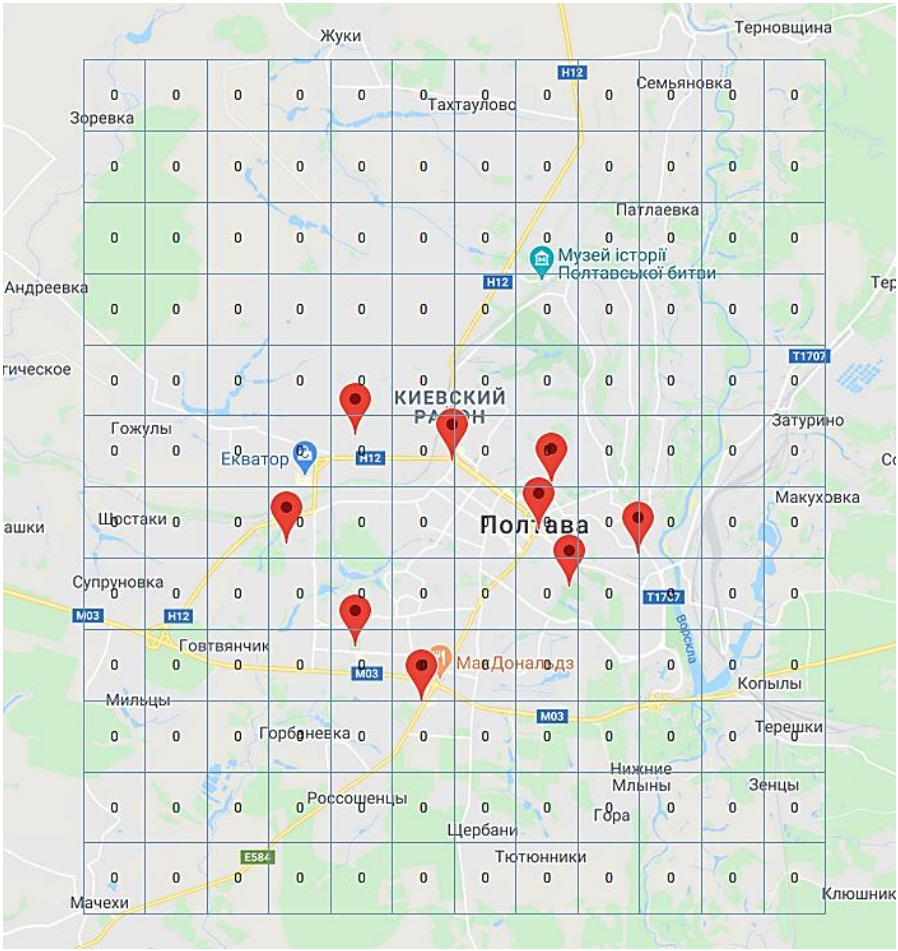

Fig. 2 – Improved view of the public monitoring grid

To implement the notification system for atmospheric air monitoring, the WordPress CMS tool was chosen, which is one of the most popular CMS (content management systems). A content management system is a set of various scripts for creating, editing and managing a site, in professional jargon such systems are

called engines. These systems allow you to create publications and are responsible for displaying media elements and placing widgets.

Fig. 3 – Appearance of the sensor

Due to its popularity, this system has gained very good support in the form of an extensive community, and one of the richest databases of plugins for various types of tasks.

In addition, it is a free open-source platform with open-source code.

The most important advantage among frameworks and other CMS is the quick deployment of small projects. Clear and simple admin panel for the site editor. Easy project support. Usually, during development, this engine covers most of the functionality of typical projects, and the smallest part needs to be added to your tasks by modifying the theme or creating appropriate plugins. During the implementation of this project, the topic modification method was used.

The WordPress theme is a basic set of PHP, JS, and CSS files that are used to output information from the database in the form required for the design of the future project. In other engines and frameworks, what is called a theme in WordPress is usually considered a template. However, historically, for compatibility with previous versions of Wordpress, the typical MVC architecture is

not used, and in the context of considering Wordpress, it is more correct to use the term "theme" instead of template.

The Joints WP theme was used to develop the site - and empty WordPress theme with a basic set of functions that includes the Foundation CSS framework.

To display the model of the distribution of pollutants in the atmospheric air of the city, the GMapsTable JavaScript library was used, which is based on superimposing an HTML object on Google Maps according to the given coordinates, usually by a similar method, SVG objects are superimposed on Google maps. In this library, this method is adapted for overlaying an HTML table for data visualization. With the help of this library, the output of grouped data on the city grid, rather than point data, is realized.

A website's interface is the set of ways and means by which a user interacts with any web page. The layout of the site is a scheme of pages on which graphic and text elements are located. In other words, the layout of the site is the frame on which the design is formed and the pages are filled.

The site itself is one page with data on the level of atmospheric air pollution for the day. The map is completely positioned to the full height and width of the screen. On the left is a floating sidebar, which is the main element for navigation. It has the following elements: tabs to switch between PM2.5 and PM10 sensors, which have switches for every 6 hours of data and a calendar to navigate by day. Toggling the tab and internal switch changes the data visualization on the map and the pollution scale image for this type of sensor.

Interface elements are implemented using meta boxes. Metaboxes are specific properties of the post, which are usually added to the site structure by plugins. These are panels that contain all the necessary elements that are necessary for editing post data. They are located on the editing screens of the admin panel, where such possibilities as grid control are implemented (2 grids have been created: 7x7 and 12x12 cells), and with the help of tabs, the user will be able to quickly switch between sensors and add information every 6 hours for each of them. By default, these fields will be mandatory.

It is the last publication that will be displayed on the main page (Fig. 4).

First of all, it is necessary to name the post in (dmy) format to generate a page link in the form http://city-air-dust.ho.ua/map/07-06-2020/. In the left sidebar of the post-publication, the date of publication is changed for the desired day, thus determining the day on which the post will be published, which is necessary for the correct determination by the engine of the very last post to which redirection will be made from the main page of the site. In the ACF widget of the CPT: Maps Data group, the desired grid size is selected to fill the data. In the lower part of the widget, the PM2.5 and PM10 tabs are available, which contain fields for filling in information about the sensors every 6 hours. Completion of both tabs is mandatory by default. If these fields are not filled in, when you click the publish button, the post will not be published, and the fields that must be filled in will be highlighted.

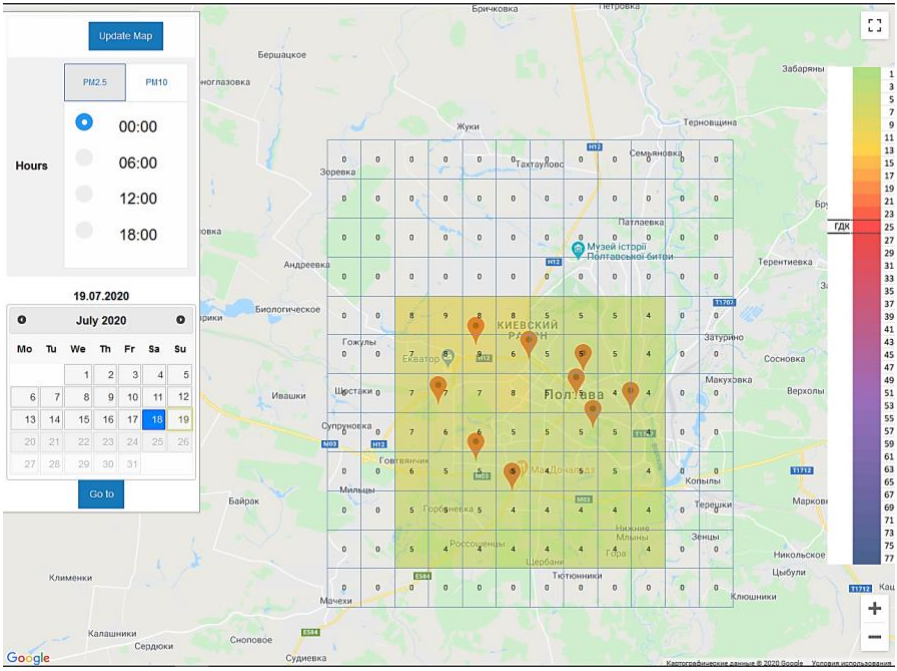

Fig. 4 – View of the main page of the public information system regarding the state of atmospheric air

After the publication of the post, by going to the main page of the site, there is a redirection to the last post with a visualization of the state of atmospheric air pollution in a convenient visual form on the map.

To go to the page, you need to select the desired date in the calendar and click the "go to" link, after selecting the date, the post link is generated automatically. The current date of the post is displayed in the upper part of the calendar so that the user understands the date for which the data is displayed.

After clicking the Go to link, a post for another day will be loaded. For the convenience of users, if there is no publication of observations for a certain day, this date cannot be selected in the calendar.

When switching between the PM2.5 and PM10 sensor tabs, the data on the map changes and the scale image for that sensor changes. Also, when switching tabs, the data is displayed exactly for the hour that was selected last.Therefore, a website was implemented for the publication of the results of measuring the level of atmospheric air pollution with the help of public monitoring. As a result, calculations and analytical studies are transformed into user-friendly thematic

maps of PM2.5 and PM10 air pollution in the city. The possibility of implementation of the Procedure for state monitoring in the field of atmospheric air protection was considered, taking into account the results of the implementation of public monitoring of the city.

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COMPARATIVE ANALYSIS OF THE WASTE MANAGEMENT SYSTEM IN UKRAINE AND THE EU

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Introduction. Innovative enterprise solutions are a necessary factor for success and competitiveness in the modern business environment. Rapid technological progress and changes in consumer demand require enterprises to constantly update and improve their products, processes and services. In this context, a scientific study was conducted on the issues of innovative development of the enterprise in the field of a safe waste management system. The purpose of this scientific work was the research and analysis of factors affecting the successful implementation of the innovative potential of enterprises in the field of waste processing, as well as the development of recommendations for the effective implementation and management of the system of safe waste processing. The study was based on the analysis of modern theoretical approaches, as well as on practical examples of successful innovative activities of enterprises. The justification of innovative solutions of enterprises in the field of safe waste processing should be based on the principles of purposefulness, comprehensiveness, planning, orientation to market needs, availability of sufficient information and strategic direction. However, when implementing an innovative path of enterprise development, a number of problems may arise, including insufficient government funding, limited access to information and consulting, limited participation in international programs, problems of financing and transfer of innovations, legal inconsistencies, as well as insufficient training and skills in the field of entrepreneurship. Only this approach will ensure the stability, competitiveness and success of the enterprise in the long term.

It is worth noting that the sector of safe waste collection is gaining more and more importance in the international arena. Growing awareness of environmental issues and the need for effective waste management are driving the development of this sector. One of the key trends in the field of safe waste collection is the expansion of the legislative framework. Many countries are adopting new regulations and policies aimed at improving the efficiency of safe waste collection and treatment. Overall, the global field of safe waste collection continues to grow, with increasing popularity of separate collection and public participation in recycling programs. Efficiency, sustainability and reducing the negative impact on the environment through proper disposal and recycling of safe waste are important

priorities. The expansion of the safe waste collection and processing market indicates its importance in the economy. Companies specializing in these processes demonstrate sustainable growth and receive new opportunities for development. Growing public awareness of the waste problem and active participation in recycling and recycling programs are becoming more common. Companies committed to social responsibility contribute to increasing education about recycling and efficient use of resources.

Let's analyze literary scientific approaches to the topic.One of the most pressing challenges in the face of rapid industrialization is environmental sustainability. Untreated or non-refined waste can emit toxic and hazardous materials to the environment, contributing to the growth of pathogenic microorganisms. Inadequate waste management or segregation can give rise to the generation of hazardous materials that can impose major costs on organizations. One could argue that contamination and massive amounts of unmanaged waste will represent one of the most serious threats facing humanity. It will be extremely important for societies to implement effective waste management. Waste management involves a complex process that, besides disposal activities, involves such mechanisms as collection, transportation, temporary storage, processing, and dumping. This process is concerned with properly managing and disposing waste or recycling and reusing [1]. In most middle-income or third-world countries, factory managers often dump their waste, without any supervision, along roads or in open spaces so that it may be naturally disintegrated or incinerated. They may even leave waste in sea water. Such unjustifiable actions can lead to serious health and safety issues, insanitary conditions, and contaminations. Insanitary conditions and poor management can give rise to various problems such as a growing number of pests, contaminated runoff water and leachate discharge, and social unrest due to disgusting landfill odors. Also, collected wastecan pose major health issues to individuals. Waste disposal through the traditional waste management system, which operates on a daily basis, is extremely impractical and costly. Recycling bins have also proven to be widely ineffective [1]. Such observations underscore the urgent importance of using smart technologies in industrial sectors. Recently, novel ways of waste management through Industry 4.0 (I4.0) smart technologies have come to the fore. Such technologies can serve such processes as reusing, recycling, and repairing industrial waste. Smart technologies can help replace the traditional waste management systems with new systems equipped with smart sensors, and to provide a real-time supervision mechanism and a more advanced management structure. Using smart technologies (either in combination or separately in some cases) in industrial waste management can enhance disposal or recycling operations. However, if such technologies are implemented in organizations without specifically and scientifically formulated plans and without considering types of waste, they will fail to be helpful and can even impose huge costs on organizations. Many studies have explored industrial waste and challenges to waste

management, although they have mostly focused on solid industrial waste. However, industrial waste also includes leachate and wastewater, which are usually poured into water bodies by organizations, and thus damage aquatic ecosystems. To the best of our knowledge, no study has ever explored all industrial wastes simultaneously or investigated their challenges comprehensively. Similarly, no study has handled proper industrial waste management by focusing on indicators and solutions offered by smart technologies. Probing into the challenges of industrial waste management and selecting appropriate smart technologies to respond to such challenges are activities that face a huge degree of uncertainty, which has remained unaddressed in the literature.

Waste management aims to protect human health and the environment by reducing adverse impacts associated with waste generation and treatment. Nevertheless, waste management system performance is typically not monitored based on environmental impacts but based on indicators such as recycling rates. As part of study [2], Environmental Waste Utilization (EWU) is introduced as an indicator to monitor the capability of waste management systems to reduce the adverse impacts of waste generation and management. EWU quantifies the share of the environmental value of waste which is preserved through waste management. It is operationalized via a spreadsheet-based calculation tool, the EWU Dashboard. Case studies on plastic packaging waste, PAH-contaminated road debris, and food waste are presented to demonstrate the application range of EWU and its advantages against material efficiency indicators. It is shown (Fig. 1) that EWU-based monitoring allows for identifying environmentally preferable waste management strategies and enables sound decision support.

Rapid population growth and urbanisation have accelerated waste generation, and effective waste management has become a major challenge worldwide. With advances in technology and management methods, waste management strategies have begun embracing digitalisation, leveraging the Internet of Things (IoT), big data analytics, cloud/edge computing, machine learning, 5G communication, and blockchain technologies (Fig. 2). Amongst them, the blockchain technology has the structural features of achieving information security and integrity without central guarantees. Blockchain also meets the data record/storage needs of waste management and the design of new mechanisms for effective waste management. These benefits make blockchain an attractive technology in the field of waste management, with researchers and practitioners alike investigating its broad applications to support sustainable waste management.

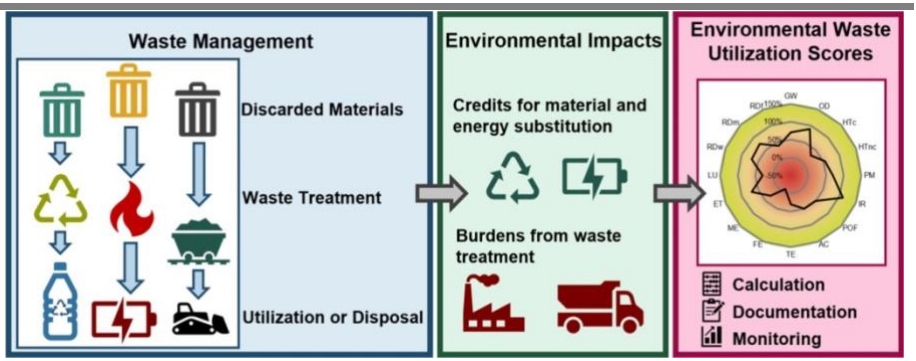

Fig. 1 – Environmental Waste Utilization score to monitor the performance of waste management systems [2]

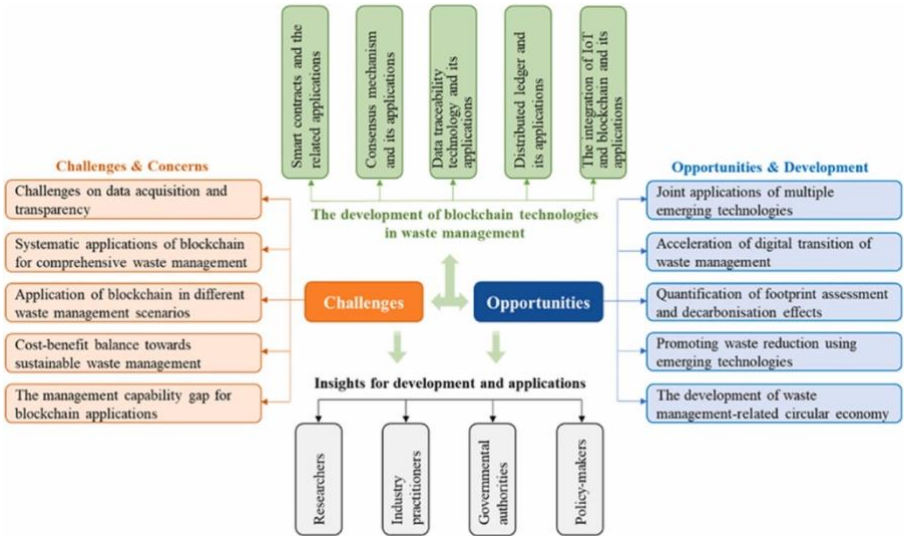

Fig. 2 – Blockchain technology applications in waste management [3]

However, this emerging technology has not yet been widely accepted by potential users. To further champion the application of blockchain technology, this review paper provides a systematic overview of the various pathways in which the technology has been applied in the waste management industry and further discusses its related challenges and opportunities via considering the promising prospect of combining blockchain technology with IoT, artificial intelligence (AI) and life cycle assessment (LCA). The study [3] also provides insights for interpreting some emerging applications of blockchain in the field of waste

management and clarifying the research paths in the context of blockchain, digitalised waste management, and circular economy.

The general practice of waste management is presented in the following literary sources [4-6]. Undoubtedly, the presented topic is relevant and requires detailed research.

Main Body. At the global level, the industry of safe waste collection is gaining more and more importance. Growing awareness of environmental problems and the need for effective waste management is a priority task for the development of many countries.

Sweden, which is one of the world leaders in the use of waste-to-energy technology, burns about 2.5 million tons of waste every year to generate electricity or heat. Dozens of waste processing plants and "garbage" power plants provide energy for about a million families (10% of the population). In Sweden, 99% of waste is used as fuel for power plants or as raw material for production.

In Norway, four tons of waste has the same energy value as one ton of fuel oil, which can heat a house for six months. One plant in Norway, working at full capacity, can provide heat and electricity to all schools in Oslo and 56,000 homes.

In Finland, like many countries of the European Union, there is a system of deposit value of packaging, where the buyer pays for the product and for the packaging (usually cans and bottles with drinks). This amount is fixed, and the buyer can return it by returning the used container to the store. The deposit value is always indicated on the package, and machines for returning containers are installed in many places, such as supermarkets, gas stations and small shops. In addition, there are benefits in the country for the payment of housing and communal services for those who sort garbage qualitatively and avoid its excessive generation. This makes it possible not to pay utility bills for 2 months a year.

The main trends observed in the system of safe waste management:

- expansion of the legal framework: many countries adopt new legal norms and policies aimed at increasing the efficiency of safe waste collection and treatment. This includes the creation of special rules for the disposal of hazardous substances, the implementation of safety standards and regulations for the collection and transportation of waste;

- market expansion: the collection and processing of safe waste is becoming an increasingly important sector of the economy. Companies specializing in the collection and disposal of waste demonstrate sustainable growth and receive new opportunities for development. Innovative technologies for processing waste and using it as resources are emerging;

- increasing public awareness: society is increasingly aware of the problem of waste and its impact on the environment. Separate waste collection and public participation in recycling programs are growing in popularity. Corporate social

responsibility campaigns actively promote education about recycling and efficient use of resources;

- technological progress: the development of new technologies in the field of safe waste collection and processing is becoming more and more active. Innovations include the use of biotechnologies, plasma gasification, high-temperature processes and other processing methods that allow reducing the impact on the environment and efficiently using waste.

Globally, the safe waste collection industry continues to grow, and there is a demand for innovation and improved waste management. Priorities include efficiency, sustainability and minimizing negative impact on the environment through proper disposal and recycling of safe waste.

Ukraine is at the stage of development of the field of waste processing, which is considered promising for investment. Today, Ukraine's losses amount to millions of tons of resource-valuable materials contained in household waste due to the lack of a recycling system, including separate collection, which can potentially be used in economic circulation.

According to the Law of Ukraine "On Waste", the main priorities of state policy in the field of waste management are the following directions [7]:

- ensuring full collection, timely neutralization and disposal of waste, as well as compliance with ecological principles during their processing;

– minimization of waste generation and reduction of its danger;

– integrated use of primary material resources;

– support for the maximum possible utilization of waste;

– safe disposal of waste that cannot be processed by developing appropriate environmentally safe technologies and practices for their management.

A more specifically considered issue of the state of the enterprise's industry more accurately reflects the trends in the innovation policy of the industry. Today, the industry of safe waste collection is becoming more and more aware and innovative. The state is trying to promote ideas that will positively affect the development of an innovative enterprise in the field of household waste collection. Based on the priorities of state policy, the main trends and directions of development of the studied industry can be identified:

– expanding the use of technologies: the introduction of new technologies in the collection of safe waste contributes to the improvement of the efficiency and environmental friendliness of the process. For example, the use of automated sorting and recycling systems, the implementation of information systems for waste monitoring and management, the use of drones and satellite surveillance to control waste collection;

– development of innovative recycling methods: the industry of safe waste collection is looking for new and effective recycling methods that allow to reduce the impact on the environment as much as possible and realize resource saving. For example, the development of new technologies for chemical waste processing, the

use of biological methods of cleaning and recycling, the introduction of new materials and processes in waste management;

– creation of environmentally sustainable solutions: in the collection of safe waste, more and more emphasis is placed on the creation of environmentally sustainable solutions. This means the implementation of a waste collection and sorting system with the aim of further processing and use in production, reducing the amount of waste, increasing energy efficiency and reducing emissions of harmful substances;

– promotion of innovation and start-ups: in the field of safe waste collection, there is an increase in support and stimulation of innovative start-ups. State programs and investment funds provide financial support and acceleration to young companies that develop new technologies and solutions in the field of safe waste collection and processing;

– social responsibility: awareness of social responsibility is growing in the field of safe waste collection. Companies set themselves the task of not only ensuring efficient waste processing, but also of contributing to the creation of jobs, supporting local communities and influencing positive changes in society.

These directions and innovations are aimed at improving the efficiency, environmental friendliness and sustainability of the safe waste collection industry, as well as at solving environmental problems and ensuring sustainable development.

The main strategic tasks are to reduce the volume of solid household waste (SWW), which is sent to landfills, by using modern environmentally-oriented technologies for their collection, storage and industrial processing, as well as in environmentally safe disposal.

For a more complete analysis of the industry, it is necessary to conduct a PEST analysis.

PEST analysis (also known as PESTEL analysis or PESTLE analysis) is a strategic analysis tool used to assess the external environment in which an organization or industry operates. The acronym PEST comes from the four factors analyzed: Political, Economic, Socio-cultural and Technological.

The main purpose of the PEST analysis is to identify external factors that can affect the success of the organization or industry. This analysis helps to understand a wide range of influences such as political changes, economic trends, cultural characteristics and technological advances. It allows you to identify opportunities and threats arising in the external environment, which helps in formulating strategies and making management decisions.

The main advantages of PEST analysis are as follows:

1) Broad overview: By analyzing the political, economic, socio-cultural and technological context, a PEST analysis provides a more complete overview of the external environment.

2) Identification of opportunities and threats: Analysis helps identify new opportunities for development and identify potential threats, providing an evidence-based basis for strategic planning.

3) Forecasting changes: PEST analysis helps predict possible changes in the external environment, which allows an organization or industry to prepare for them and adapt.

4) Support of strategic decisions: The results of the analysis can be used to develop strategic plans and make managerial decisions oriented towards the external environment.

In summary, PEST analysis is a useful tool for evaluating external factors that affect an organization or industry. It helps to understand the broader context and make informed strategic decisions to adapt to changes in the environment (Table 1).

Table 1 – PEST analysis of the safe waste collection industry

Aspect	Description
Political	– existing legislation and regulations; – public pressure;
Ecological	– market potential; - economic stability;
Sociocultural	– public awareness; – cultural news;
Technological	– innovative technologies; – infrastructure.

1) Legislation: Ukraine has a regulatory framework that defines the requirements for the collection, processing and disposal of safe waste. There are laws and regulations regulating the responsibility of businesses and citizens in the field of waste management;

2) Public pressure: public expectations for environmentally friendly waste management are growing. Public organizations and activists influence policy-making and encourage businesses to take a more responsible approach to waste collection and disposal;

3) Market: Increasing awareness of waste and environmental management is driving demand for safe waste collection and recycling services. The market has potential for development and investment attraction;

4) Economic stability: stable economic development contributes to an increase in financial resources that can be allocated to the development of infrastructure for waste collection and disposal;

5) Public awareness: public awareness of environmental issues and the need for effective waste management is growing. Support for separate collection and public participation in recycling programs is growing;

6) Cultural influences: Cultural beliefs and customs can affect the efficiency of waste collection and disposal. For example, in some regions there may be traditions that promote environmentally unfriendly waste management;

7) Innovative technologies: the introduction of new technologies, such as the use of biogas plants or automated waste collection systems, can improve the efficiency and environmental sustainability of the waste management process;

8) Infrastructure: the development of infrastructure for waste collection, processing and disposal in Ukraine may affect the availability and efficiency of these services.

Considering the mentioned aspects of the PEST analysis, it can be concluded that the industry of safe waste collection in Ukraine has the potential for development and improvement. There is support from political bodies, the public and the economic environment. The introduction of innovative technologies and the modernization of infrastructure can contribute to improving the efficiency and sustainability of waste management.

The main measures that contribute to solving the problem of solid household waste include [7]:

– creation of infrastructure for the system of separate collection of waste components and formation of separate streams;

– development of the waste processing system, including sorting, briquetting, composting and application of thermal technologies, such as incineration, thermal and biothermal decomposition, as well as gasification;

– the use of anaerobic and other biotechnologies is also an important aspect;

– development of industrial infrastructure aimed at the use of secondary raw materials obtained from waste;

– ensuring ecologically safe disposal of waste or residual products of waste processing at landfills.

These measures are aimed at reducing the amount of waste, improving its management and ensuring the use of secondary raw materials to reduce the negative impact on the environment and create a more sustainable and environmentally safe waste recycling sector [7].

Ukraine is actively working to solve problems in the field of safe waste collection, but there may still be a lot of work to achieve high standards of environmental sustainability. To do this, it is important to continue to strengthen legislation, promote innovation and involve the public in active participation in waste collection and recycling programs.

There are several potential benefits to a municipally owned safe waste collection business. The following can be distinguished among them:

– control over waste: a company owned by the municipality may have a greater ability to control the collection and treatment of safe waste in its territorial community and allows for effective organization and implementation of standards of safe waste treatment;

– impact on environmental sustainability: the utility company has the opportunity to influence the development of environmentally sustainable waste management. By implementing modern technologies and innovative approaches to the treatment and processing of safe waste, the enterprise can help reduce the negative impact on the environment and improve the state of the ecosystem;

– market expansion: a utility may have an advantage when entering the safe waste collection market. Such enterprises often have priority when concluding agreements with local self-government, state institutions and enterprises located on their territory. This can ensure a stable flow of orders and long-term cooperation;

– attraction of investments: the utility company can attract investments from local authorities or other sources of financing to expand its activities or modernize the existing infrastructure and can contribute to the improvement of technical equipment, work efficiency and increase of the company's capacities;

– social responsibility: a community-owned enterprise usually has a social responsibility towards its employees and the local population. It can provide stable employment, decent working conditions and contribute to the development of social programs and projects for local communities.

Given that a safe waste collection company is municipally owned, there may be some disadvantages to contend with:

1) Bureaucracy and slow decision-making: communal structures can have a complex management apparatus that slows down decision-making processes and the implementation of new initiatives. This can affect the speed of response to changes in the field of safe waste collection and innovative approaches.

2) Lack of competition and innovation: There may be less competition in the utility sector compared to private companies. This can lead to less incentive to innovate and improve waste collection and disposal processes. It is important to stimulate utility enterprises to constantly improve and introduce new technologies.

3) Financial constraints: Utilities often face financial constraints and insufficient funding. This can make it difficult to introduce new technologies, upgrade infrastructure and train staff. It is important to ensure adequate financing and attracting investments to support utility enterprises.

4) Absence of a competitive market: in communal property there may be no or limited competition with private enterprises. This can lead to insufficient efficiency and quality of safe waste collection services. It is important to create conditions for the development of competition and to stimulate utility companies to improve quality and efficiency.

Therefore, a community-owned safe waste collection facility can have many benefits, including waste control, impact on environmental sustainability, market

expansion, investment attraction, and social responsibility. It is important to ensure effective management of utility enterprises, to attract qualified personnel and support their development. It is also necessary to create favorable conditions for partnerships between utilities and private entities to improve the quality and efficiency of safe waste management.

The implementation of innovative solutions in the field of safe waste collection will lead not only to achieving certain economic effects, but also social ones. The use of the latest technologies and processes can reduce the costs of waste collection, processing and disposal. This can lead to reduced costs for waste disposal companies and the creation of new markets and opportunities for innovative companies in this field. In addition, reducing environmental pollution and improving air and water quality can reduce the costs of treating pollution-related diseases, which benefits society as a whole.

However, the social effects of innovation in this field are just as important. Reducing emissions of harmful substances and environmental pollution can have a positive effect on people's health, especially those who live near waste collection and treatment sites. This can improve the quality of life of residents and reduce the risk of various diseases. In addition, innovative approaches to waste collection can help create new jobs and support economic development in the industry.

It is important to note that the implementation of innovative solutions in the field of safe waste collection can contribute to increasing the environmental awareness of society. The widespread use of the latest technologies and practices can inspire people to change their behavior and contribute to the introduction of a more sustainable lifestyle. This can have a positive impact on conserving natural resources and reducing waste, contributing to a more sustainable and environmentally friendly society.

The implementation of innovative solutions in the field of safe waste collection will not only help to achieve certain economic advantages, but will also positively affect social progress. It will promote change for the better, ensuring the sustainability of the economy, improving the quality of life and preserving the environment for future generations.

To assess the situation at the enterprise, a SWOT analysis should be conducted. This tool allows you to analyze the strengths and weaknesses, opportunities and threats associated with the implementation of innovations. SWOT analysis helps to identify the company's strengths (experienced personnel, strong brand, financial resources, unique technologies), identify weaknesses (budget constraints, instability of operational processes, insufficient resources), recognize opportunities (new markets, growing demand, changes in legislation , technological breakthroughs) and identify threats (competition, changes in consumer preferences, political instability, changes in legislation). SWOT analysis provides the company with a basis for developing strategies aimed at successfully implementing innovations and achieving competitive advantages.

The obtained results of the strengths and weaknesses of the SWOT analysis of Poltava Communal Motor Vehicle Enterprise 1628, which implements the safe waste management program, are shown in Table 2.

Table 2 – Determination of strengths and weaknesses of Poltava Communal Motor Vehicle Enterprise 1628

Strong sides	Weak sides
– high level of digitization; – availability of own production facilities; – availability of own unused space; – highly qualified engineering and technical staff; – being in communal ownership; – availability of young, creative and energetic employees of financial services; – many years of experience in the market; – positive dynamics of employee labor productivity, capital return and material return; – growing interest of investors; – availability of stakeholders and an effective organizational structure; – clear division of duties between employees and existence of a social task; – reliable suppliers of raw materials and materials; – absence of an analogue enterprise.	– lack of own financial resources; – the development strategy is not fully defined; – rising prices for materials and wages; – outdated car fleet; – an outdated system of calculating the cost of customer service; – the complexity of making risky decisions; – lack of permanent investors.

The company has strengths that can contribute to its success and competitiveness. A high level of digitalization, the presence of own production facilities, unused space, qualified personnel and many years of experience in the market are significant assets that allow us to effectively use digital technologies, improve productivity, attract investors and satisfy customer needs. Having young, creative and energetic employees in financial services can promote innovation and strategic development.

It is also important to use the availability of stakeholders and an effective organizational structure to ensure cooperation and interaction between all stakeholders. A clear division of responsibilities between employees will help ensure efficient work and avoid unnecessary duplication of functions.

The existence of a social task indicates the responsibility of the enterprise to society and the desire to make positive changes in the surrounding environment. This can contribute to increasing the company's reputation and attracting favorable perception from customers and the public.

Reliable suppliers of raw materials are an important resource that can guarantee a stable and continuous supply of the necessary components for production. This allows you to avoid problems with interruptions in production and ensure product quality.

The absence of an analogue enterprise may indicate the uniqueness and unrepeatability of the enterprise's offer on the market. This creates opportunities for development and taking a leadership position in your field.

However, there are also weaknesses that can potentially affect the company's operations. Lack of own financial resources, not fully defined development strategy, and other problems, such as rising prices for materials and wages, an outdated vehicle fleet, and a system for calculating the cost of customer service, can complicate the operation and development of the enterprise.

To achieve success and ensure sustainable growth, the company should actively work on solving weaknesses, attract additional financial resources, develop a clear development strategy, modernize the fleet and make improvements to the customer service system. It is also important to attract new investors and maintain positive dynamics of productivity and work efficiency.

Despite the existing challenges, the presence of strengths and opportunities allows the company to work on the market, ensuring stability and development in the digitalized economy.

The general conclusion from the indicated strengths and weaknesses is as follows: the enterprise faces some problems, in particular technological lag, unsuccessful investment policy, economic crises and political instability. Such factors can complicate the successful development of the enterprise and affect its competitiveness (Table 3).

However, at the same time, the company has a number of strengths that create the potential for successful development. In particular, this is the expansion of the area of activity, conducting scientific research, creating a social mission and expanding the types of activities. Also important factors are the attraction of investors, the growth of labor productivity and material security of employees, the modernization of technological equipment and the creation of an organizational culture.

So, even though the company faces challenges in its operations, having the potential for change and development can contribute to overcoming problems and achieving success in the future. Emphasis should be placed on addressing weaknesses, such as technological backwardness and the instability of the legal framework, as well as on maximizing the use of strengths to stimulate growth and improve enterprise performance.

Innovative policy for an enterprise whose main activity according to Classification of types of economic activity is the collection of safe waste must be intertwined with modern trends in the field of waste management and take into account key nuances regarding transportation, storage, processing or disposal. In this case, it is important to focus on the following areas for innovative activities at a municipal trucking company that deals with household waste management.

Table 3 – Definition of market threats and opportunities for innovative activity of Poltava Communal Motor Vehicle Enterprise 1628

Market threats	Market opportunities
– technological lag behind enterprises of European countries; – unsuccessful investment and innovation policy; – crisis phenomena in the country's economy; – high rates of inflation; – instability of the legislative framework; – political instability; – low level of introduction of innovations; constant pollution of the environment;	– expanding the area of activity; – conducting scientific research in the field of processing; – creation of a social mission; – expansion of new activities and services; – savings due to recycling and sorting; – attraction of investors; – increase in labor productivity and material well-being of employees; – increasing the profitability of the activity; – modernization of technological equipment; – creation of organizational culture at the enterprise; – appearance on the market of a zero-waste or low-waste enterprise.

– implementation of effective waste collection and sorting systems: development and implementation of innovative methods of collection and sorting of household waste can help reduce the amount of waste, increase the percentage of recycling and contribute to environmentally sustainable development. It is necessary to consider the option of using automated sorting lines, implementing a separate waste collection program and organizing collection points in important points of the city;

– use of energy technologies for waste processing: review the possibilities of using innovative technologies, such as biogas plants or pyrolysis, for processing organic waste into renewable energy. This will reduce the negative impact on the environment and efficiently use resources;

– implementation of information technologies to optimize processes: the use of digital technologies and information systems can contribute to effective route planning, monitoring of container occupancy and resource planning. The use of mobile applications, sensors and a waste management system can improve efficiency and increase the quality of services provided.

Pyrolysis is a process of thermochemical decomposition of organic materials at high temperatures in conditions of limited air access. As a result of this process, waste is decomposed into solid, liquid and gaseous fractions. Various fractions, such as biofuels, syngas or chemicals, can be used as energy sources or raw materials for other processes. Pyrolysis can be particularly effective for processing organic waste such as straw, wood or agricultural waste.

Since Ukraine is closely connected with the countries of the European Union and is gradually integrating into it both economically and legislatively, innovative measures should be taken into account precisely in this context. In Europe, there is considerable attention to environmentally sustainable development and effective waste management. According to the conducted research, the following main ways were identified, taking into account the European experience of safe waste management:

– use of European standards and best practices: study of European standards and best practices for household waste management can help the enterprise to improve its activities. Research of best practices in European countries, use of European regulatory documents and participation in international conferences and exchanges can bring new ideas and approaches;

– involvement in European programs and initiatives: European programs and initiatives aimed at supporting environmentally sustainable development and waste management can provide financial and technical support. The enterprise can join such programs, receive financing for the implementation of innovative projects, as well as cooperate with other European partners to exchange experience and knowledge;

– development of the recycling and sorting system according to European standards: it is important to implement modern waste sorting and processing methods that meet European standards and requirements. This may include the development and implementation of new sorting technologies, modernization of equipment and infrastructure for waste processing in order to achieve high rates of recycling and reuse;

– public encouragement and education: involving the public in the process of waste sorting and environmentally conscious consumption can be an important aspect. The organization of information campaigns, trainings and educational events aimed at raising awareness and involving the public can contribute to improving the quality of waste sorting and processing.

These approaches will help the enterprise to ensure effective waste management, taking into account European experience and principles of sustainable development.

The main strategic directions for Poltava Communal Motor Vehicle Enterprise 1628 may include:

– improvement of the sorting system;
– expansion of processing infrastructure;
– conducting information campaigns and training;
– development of innovative technologies;
– partnership and cooperation.

Taking into account the restraining factors, strengths and weaknesses, threats to the possibility of introducing innovations, the following strategic directions were created for Poltava Communal Motor Vehicle Enterprise 1628 (Table 4).

The strategy for increasing the volume of waste sorting and processing involves the expansion and modernization of sorting lines and processing facilities, the introduction of innovative technologies and the attraction of additional resources and investments. The implementation of these measures will lead to an increase in the volume of waste processing, an improvement in the quality of sorting and recycling, and a decrease in the amount of waste entering the landfill.

The strategy for improving the waste management system includes the development and implementation of effective methods of waste collection, transportation and storage, the establishment of a monitoring system to control the quality and quantity of sorted waste, as well as the implementation of a system of responsibility and regulation of waste management. These measures will help improve the waste management system, ensure an efficient collection and recycling process, and improve control over the quality and quantity of sorted waste.

The strategy for promoting environmental awareness and involving the public includes the organization of educational campaigns and training events on waste management, conducting information campaigns about the benefits of sorting and recycling waste, as well as involving public organizations and activists in joint work with waste. The implementation of these measures will contribute to increasing the environmental awareness of the public, changing the practices of the population regarding the responsible attitude to waste and ensuring a positive impact on the environment.

The strategy for the development of innovative technologies and products for waste disposal involves investing in research and development of new waste processing technologies, cooperation with scientific institutions and innovative enterprises to create new products using waste, as well as the introduction of innovative technologies in the process of sorting and recycling. These measures will increase the efficiency of waste disposal, create new products and materials using waste, and reduce the negative impact on the environment.

Table 4 – Strategic measures for the formation of the innovative policy of Poltava Communal Motor Vehicle Enterprise 1628

Strategy	Measures for implementation	Result
Increasing volumes of waste sorting and processing	– expansion and modernization of sorting lines and processing plants; – introduction of innovative technologies to improve the sorting and recycling process; – attraction of additional resources and investments;	–increase in the volume of waste to be processed; –improving the quality of sorting and processing; –reduction of the amount of waste entering the landfill;
Improvement of the waste management system	– development of effective methods (collection, transportation, storage of waste); – establishing a monitoring system to control the quality and quantity of sorted waste; – implementation of the system of responsibility and regulation of waste management;	–implementation of effective methods (collection, transportation, storage of waste); –establishing a monitoring system to control the quality and quantity of sorted waste; –implementation of the waste management system;
Promotion of environmental awareness and public involvement	– organization of educational campaigns and training events on waste management; – conducting information campaigns about the benefits of waste sorting and recycling; – involvement of public organizations and activists in joint work with waste;	–raising public awareness of environmental issues and the importance of waste management; –changing the attitudes and practices of the population regarding a responsible attitude to waste;
Development of innovative technologies and products for waste disposal	– investment in research and development of new waste processing technologies; – cooperation with scientific institutions and innovative enterprises to create new products using waste; – introduction of innovative sorting and processing technologies.	–increasing the efficiency of waste disposal; –creation of new products and materials using waste; –reduction of negative impact on the environment.

It is worth noting that the company is gradually introducing modern, trendy and at the same time innovative measures that greatly facilitate and simplify its work. For example, there is a route schedule on the company's website, which shows the time, place and number of cars that will arrive for the removal of household waste (Figure 3, a).

One of the innovative decisions made can be considered the introduction of the ecobus (Figure 3, b). Ecobus is an innovative vehicle designed to collect used batteries and electronic waste. This project was created to improve the management and recycling of waste, particularly used batteries, which contain hazardous chemicals.

Ecobus is a special vehicle equipped with special containers for collecting used batteries. This bus can run around the city and collect waste directly from residents. It has special compartments where people can drop off their used batteries and other electronic waste.

After collecting the used batteries, the ecobus delivers them to specialized facilities for recycling. There, batteries are broken down into components such as metals, plastics and other materials that can be reused or recovered. This recycling process helps avoid the release of hazardous substances into the environment and ensures the reuse of materials from collected batteries.

Ecobuses can be used as an additional waste collection tool that complements existing waste sorting and recycling systems. They help raise awareness of environmental issues and expand opportunities for recycling used batteries and electronics.

Ecobuses are just one of many examples of how innovative technologies can be used to solve environmental problems and create a more sustainable future. By collecting and recycling used batteries, ecobuses help reduce the negative impact of this waste on the environment and contribute to the conservation of natural resources.

Accordingly, the creation of a route system is a positive decision and makes life much easier for the population, but I would like to suggest its improvement. It is necessary to develop a mobile application for consumers. The use of mobile programs for garbage collection is an innovative proposition that helps businesses improve the efficiency and organization of the garbage collection process. Such applications provide a convenient and fast way to order and coordinate garbage collection through mobile devices such as smartphones or tablets.

a)

b)

Fig. 3. a – Examples of waste sorting and took it away;
b – image of the ecobus in action

We can distinguish the following advantages of using mobile applications for garbage removal at the enterprise:

– convenience and accessibility: users can order garbage collection at any time and from any place using a mobile device with Internet access. This allows

you to effectively manage the removal of garbage without the need for personal contact or phone calls;

– an automated process: mobile apps for garbage removal can be integrated with the waste removal management system at the enterprise. It allows you to automatically receive orders, generate delivery schedules and remind customers of the required actions;

– tracking and reporting: Mobile apps can provide detailed information about order status, including pickup time, trash type, address, and payment status. This allows businesses to accurately track waste removal and ensure quality of service;

– promoting environmental awareness: mobile applications can also include information on recovery and recycling processes, advice on waste sorting and environmental news. This helps to increase the environmental awareness of customers and encourages them to a more sustainable way of managing waste;

– reduction of administrative costs: the use of mobile applications allows you to automate many administrative processes related to the removal of garbage. This can lead to reduced personnel costs and improved business efficiency.

In general, the use of mobile applications for garbage collection is an important innovative step for enterprises in the field of waste management. They promote convenience, automation and environmental awareness, which helps to improve the waste collection process and reduce the negative impact on the environment.

To achieve greater effects, attention should be paid to the modernization of the enterprise with new equipment such as biogas plants. The use of energy technologies for waste processing is an important component of the waste management strategy. Innovative technologies, such as biogas plants or pyrolysis, provide new opportunities for converting organic waste into renewable energy.

Biogas plants use the process of biological decomposition of organic materials, such as food waste, sewage or plant biomass, to produce biogas. Biogas, which consists mainly of methane, can be used as an energy source for heating, electricity generation or fuel for transport. The use of biogas plants allows for the simultaneous processing of waste and the production of sustainable and renewable energy, thereby reducing dependence on traditional energy sources and reducing greenhouse gas emissions.

Regarding innovative policies, it is important to take into account modern trends in the field of waste management and focus on the implementation of efficient waste collection and sorting systems, the use of energy technologies for waste processing, and the implementation of information technologies for optimization.

In general, the developed innovative solutions will contribute to the improvement of waste management, the increase of sorting and recycling volumes,

the reduction of the impact on the environment and the creation of a more sustainable future.

Conclusion. Innovative solutions in the field of safe waste collection and processing are an important trend today. Ukraine is at the stage of development of the waste processing sector, which is considered promising for investment. Losses of resource-valuable materials are quite significant due to the lack of an effective recycling system, including separate collection. The European experience of safe waste management was analyzed in the study. On the basis of the obtained results, key factors affecting the choice of innovative solutions in this field were identified. Recommendations were developed for the formation of the innovative strategy of the enterprise, the attraction of innovative capital, the creation of a favorable innovative atmosphere, and the improvement of the management processes of innovative projects in the field of safe waste management. The need for constant updating and improvement of the innovative potential of the enterprise, active cooperation with scientific and business partners, as well as understanding the importance of effective management of innovative projects was determined. It was noted that achieving success in the field of innovative development is a key factor for ensuring sustainable competitive advantage and strengthening the company's position on the market. A detailed analysis of the current situation was carried out, a plan for the implementation of innovative solutions in the waste management system was developed, and a control mechanism for their implementation was developed.

For a more complete analysis of the industry, a PEST analysis was applied based on an assessment of the political, economic, socio-cultural and technological environment. The main measures that contribute to solving the problem of solid household waste have been formed. The advantages and disadvantages of enterprises engaged in waste collection are determined. In order to assess the situation at the enterprise, a SWOT analysis was conducted, which made it possible to analyze the strengths and weaknesses, opportunities and threats associated with the introduction of innovations. Based on the calculations, a program was developed to ensure effective waste management, taking into account European experience and principles of sustainable development. The expediency of integrating the route system, which greatly facilitates the life of the population, the introduction of the ecobus, the development of a mobile application for consumers, which allows you to order and coordinate the removal of garbage through mobile devices, is considered. Modernization of the enterprise with the help of new equipment is defined as the direction of effective waste management. Innovative technologies, such as biogas plants or pyrolysis, provide new opportunities for converting organic waste into renewable energy. The modern trends in the field of waste management allowed us to focus on the following innovative areas related to the use of efficient waste collection and sorting systems, the use of energy

technologies for waste processing, and the introduction of information technologies for optimization. The developed innovative solutions will help to improve waste management, increase sorting and recycling volumes, reduce environmental impact and create a more sustainable future.

The financial projections presented in this article relate to investment and operational financing needs during the reform of the waste management system. The investment plan is designed to ensure that all calculated costs can be covered from various sources of financing. In addition to international organizations, the state budget of Ukraine, the local budget of the Poltava region, the budgets of territorial communities and the population in particular will be the donors of this project.

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EUROPEAN EXPERIENCE IN IMPROVING THE FINANCIAL LITERACY OF THE POPULATION AS A STRATEGY FOR EFFECTIVE PERSONAL FINANCE MANAGEMENT

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A person is always a significant subject in any economic system, as their active actions influence its development and improvement. However, the issue of the relationship between an individual and society in economic (and any other) activities, as well as the philosophy of complex interactions between an individual and the state, will always be systemic problems. These problems are addressed in various ways at each stage of human historical development.

In modern Ukraine, the ideas of humanizing the economic space and prioritizing the individual as the main goal of societal development remain relatively abstract and not fully realized. However, the primary issue in Ukrainian society remains the insufficiently dynamic and comprehensive development of the individual as a personality, as well as their relatively low economic and political culture.

In the context of globalized markets, the formation and utilization of financial resources by individual citizens and households take on new significance. The opportunities for utilizing personal financial funds and the impact of individual financial decisions on both personal and public finances, as well as on business finances, have significantly increased. This stimulates both the science and practice to reconsider the role of the individual, their own resources, and decisions in their utilization within socio-economic processes [1].

Certainly, the individual motives of each economic participant influence the economic system, the formation of overall consumer demand, and investments in the economy. In the social sphere, this influence shapes behavioral standards, fosters a particular culture in all its manifestations, and promotes human development. However, on the other hand, the inaction of certain individuals in utilizing their financial resources can also have a significant impact on the economy, no less than the deliberate actions of a few specific subjects in financial-economic relations.The role of personal finances in a country's financial system has multiple dimensions. The population is the most important actor in the distribution and redistribution of the national income. The size and distribution of financial resources among individual citizens and households have a significant

impact on distribution and redistribution processes in the public, corporate, and financial sectors of the market.

In the course of the development of market-based economic practices and globalization of economic relations, the processes of forming and utilizing financial resources by citizens take on new significance. The purpose of the existence and development of economic relationships is no longer solely the wealth of society as a whole, but rather the well-being of each individual. This is associated with the expansion of opportunities to use personal finances and the increasing influence of financial planning on both personal and societal financial well-being [2].

Education, culture, habits, the level of development, and the behavior of an individual significantly contribute to their degree of self-realization in the labor market, which directly impacts their future income. On the other hand, these factors also provide the opportunity to shape economic relationships within the family and household, which has a substantial influence on the distribution and utilization of citizens' earned income.

The formation of overall consumer demand is achieved through the objective existence of personal motives of each individual and their direct impact on the economic system. In the financial system of the state, influence on consumer demand is exerted through deliberate investment of savings into the economy, thereby stimulating its development. In the social sphere, the determination of behavioral principles and the cultivation of a specific culture in all its manifestations contribute to human development.

The inertia of individuals in managing their financial resources has no less of an impact on the economic system of a country than the deliberate actions of a few participants in financial-economic relations regarding the utilization of financial resources. For example, people's reluctance to invest increases the cost of capital, and the absence of demand for a product determines the volume of production of goods or services.

Personal finance is a term that describes the process of managing one's money through budgeting, saving, or investing; it's a broad term that encompasses banking activities, insurance, mortgages, retirement planning, taxes, and other financial activities that individuals undertake with their money. It's essential to plan one's finances correctly to ensure there is enough for all financial needs, whether for short-term financial goals, retirement planning, or saving for a child's future. It all depends on how an individual manages their personal finances, so it's crucial to be financially literate to avoid making impulsive and unnecessary purchases [3].

People's economic decisions are based on family and personal budgets – a system of individual economic relations in which each person acts according to the level of market conditions in the country and their position within the economic

system. In this context, personal finance is considered a system of voluntary and equal financial relations within a household, based on private ownership, in which the process of making decisions about the organization and management of personal material and intellectual property is carried out directly by each individual.

It is important to realize that personal finances have an impact on people's behavior and economic culture, as well as their way of life, health, education, and civic engagement. The quantitative characteristics of these finances determine the overall need for a high-quality life and are an important component of the national economy and its financial system. The balance and stability of personal finances are crucial for a range of socio-economic processes and contribute to the development of human potential as a whole [4].

Decisions made in the realm of personal finances have an impact on both societal and corporate finances by involving individuals in the creation of added value. This occurs through the labor contributions of individuals, which shape their earnings, or through the creation of savings and their investment in the corporate sector, where funds generated within personal finances are transformed into corporate sector funds.

Personal finances possess specific characteristics that set them apart from public and corporate finances within the financial system.

1. Personal finances are the primary element compared to public and corporate finances, as the decisions of individuals regarding the use of their money and other capital have a decisive impact on the pace of economic development and the conditions for the formation of public and corporate finances.

2. Personal finances are a necessary prerequisite for the development and expansion of public (government) and business finances since the income generated from labor and capital resources, which create added value, is partially or entirely individual.

3. Personal finances are shaped at all stages of income distribution and redistribution and differ from public and corporate finances. However, they are an integral component of the financial system since the creation of business and government finances is based on them. This system is built on the objective existence of both private and public goods that complement each other.

4. Personal finances have a direct and significant impact on the size of disposable income in the economy. These finances consist of consumption and savings funds, which are formed and allocated by individuals, affecting the overall level of disposable income and investments. These are important factors for sustainable economic development.

5. The transformation of savings into investments in the personal financial sphere is a key factor in economic development. The larger the proportion of

citizens' savings that forms the basis for investments, the more advanced the economy becomes.

6. Personal finances are a key indicator of people's well-being, defined as the total volume of personal financial assets owned by the residents of a country, as well as the degree of their distribution and differentiation among various social groups.

Personal finances have several distinctive features.

1. Individual nature. Personal finances pertain to the monetary resources and income of a specific individual. They are individual and depend on personal needs and capabilities.

2. Complex structure. Personal finances consist of various components such as income, expenses, investments, loans, and more. Managing all these components can be a challenge for most individuals.

3. High level of risk. Personal finances are associated with the risk of losing monetary resources due to unforeseen circumstances such as job loss, unexpected expenses, inflation, and other factors.

4. Individual responsibility. Individuals bear personal responsibility for managing their finances, including the risk of loss and the investment of monetary resources.

5. Instability. Personal finances can be influenced by changes in the economic and political situation in the country. They can also depend on personal life circumstances and unforeseen events.

So, personal finances have their peculiarities and require attention and conscious management from individuals. It is important to plan and manage one's finances using various tools, such as budgeting.

Personal finances are important for both individuals and the state as a whole. For individuals, they allow for meeting life's necessities, planning for the future, building savings, and ensuring financial stability. For the state, personal finances are a crucial element of the economic system as they impact the overall macroeconomic situation in the country.

Personal finances also play a significant role in the financial system of the country. They serve as a source of resources for banks and other financial institutions and influence the financial stability of the country. It is important for the state to ensure the efficiency of financial markets and economic growth, which is possible through stable and well-developed personal finances.

Thus, personal finances are of great importance to every individual and the economy as a whole. It is essential to be attentive and consciously manage one's finances, as well as support an effective financial system for the country.

In the context of market relations, the behavior of economic agents is characterized by a focus on their own private interests, primarily aimed at maximizing benefits for themselves. However, due to imperfect competition in the

market, participants are forced to adapt to each other and make compromise decisions that satisfy the economic interests of both parties [5].

Managing citizens' personal finances is an important element of economic behavior for individuals. This process involves the formation, distribution, and utilization of corresponding monetary funds with the aim of maximizing individual and national welfare.

Personal finance management helps more effectively utilize income, analyze and optimize expenses, and create savings. The main goal of personal finance management is to achieve the most efficient and advantageous allocation of available resources. To achieve these goals, individuals need to define their financial objectives, analyze their current financial situation and policies, choose methods to achieve these objectives while considering future trends, utilize financial tools, and periodically review the plan [6].

Managing personal finances depends on various factors, including historically determined national mentality, as well as socio-demographic characteristics such as education level, wealth, age, and gender.

Effective management is a necessity for every modern individual and can bring significant economic benefits. For the country's economic development, it is important to foster a culture of personal finance management, including personal financial planning and increasing financial literacy among the population.

Creating a personal financial plan is an important step in managing one's own finances, based on a rational strategy to achieve financial goals and considering combinations of different financial instruments according to specific circumstances and anticipated needs [7].

Building a personal financial plan consists of the following stages:

1. Assessment of the current financial situation. At this stage, it is necessary to evaluate your current income, expenses, debts, and determine your financial reserves. This stage involves translating dreams and desires into clear goals.

2. Defining financial goals. At this stage, you establish the objective and timeframe for achieving specific financial goals, such as buying a home, saving for a vacation, or retirement planning.

3. Developing a strategy to achieve financial goals. During this stage, you formulate a strategy that outlines how your financial goals will be reached. This involves identifying specific actions, such as increasing income or reducing expenses, and selecting financial instruments that will help achieve these goals.

4. Identifying risks. At this stage, potential risks that may arise during the implementation of the strategy to achieve financial goals are identified. Measures to prevent or mitigate the consequences of these risks are determined.

5. Developing specific actions. During this stage, concrete steps that need to be taken to implement the strategy are outlined. This includes increasing income, reducing expenses, and selecting financial instruments.

6. Monitoring and Correction. The final stage involves continuous monitoring of the financial plan and making adjustments as necessary. In other words, you can modify your personal financial plan depending on the impact of various factors, such as unexpected expenses for a particular purchase.

Managing personal finances is an ongoing activity that needs to be carried out throughout one's life. This is because financially literate individuals not only ensure personal development but also contribute to the creation of material well-being, capital formation, and its protection.

For successful personal financial management, a certain level of knowledge is required. Financial literacy is an indicator of a person's success and signifies the ability to manage personal finances and make responsible decisions. Only with such knowledge can one create a system of rational financial behavior that allows for planning a strategy to overcome financial and economic resource shortages. However, because people often act impulsively, proper financial behavior depends on the level of financial literacy [8].

Financial behavior, in a broad sense, encompasses various actions of households and individuals related to managing their money. These actions may include aspects such as financial planning, risk reduction, savings, investment, insurance, credit and lending behavior, participation in financial games, buying and selling goods and services outside financial institutions, conducting payment transactions, and more (fig. 1).

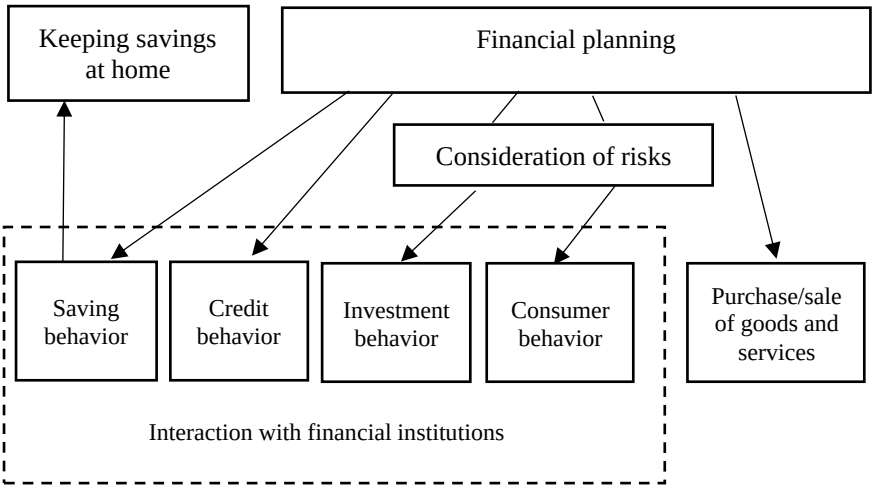

Fig.1 – Structure of financial behavior

When researching financial behavior, it is important to consider not only the objective factors that influence it but also the motivational factors that impact the choice of strategies regarding savings, loans, investments, or insurance. Additionally, motivation plays a role for all members of the family who are encouraged to participate in household activities together [9].

This is why appropriate financial education and professional assistance from experts are necessary for effective personal finance management and resolving various financial issues. Acquiring new knowledge, skills, and values can contribute to positive changes in personal finance management. Analyzing the financial behavior of the population, including the factors and motivations that influence this behavior, can help successfully implement the current state program to enhance financial literacy.

Classical financial theory investigates the financial market using models based on the principle of investor rationality. However, the emergence of market booms and crashes indicates a mismatch between classical models and modern realities. Therefore, in the contemporary scientific world, behavioral finance theory is evolving, taking into account the peculiarities of human behavior and its reflection in the state of the financial market. Understanding the impact of behavioral factors on individuals' financial decision-making processes allows for a more effective assessment of the market situation, prediction of future changes, and prevention of losses.

Based on the identification of socio-psychological factors of human activity that contribute to a more accurate examination of the main motives behind human behavior and their influence on the financial decision-making process, a new direction in modern financial science has emerged—behavioral finance. Behavioral finance takes into consideration the irrational nature of the behavior of financial market participants in conditions of uncertainty and risk when making financial and investment decisions [10].

Behavioral finance is a relatively new branch of financial theory that combines insights from psychology with conventional economic and financial theory to explain the peculiarities of financial decision-making. This field has emerged due to the inability of neoclassical expected utility theory and the efficient market hypothesis to explain a series of anomalies that arise in markets as a result of economic agents making irrational decisions.

To ensure their existence and improve the lives of their members, households make various financial decisions. Each of these decisions involves choosing between several alternatives. Behavioral science investigates how people make financial decisions, what factors influence their choice of financial products and services, and why some decisions result in profits while others lead to losses.

The classical model of financial decision-making is based on the concept of "rationality" and requires the decision-maker to think absolutely objectively and

logically, have a clearly defined goal, possess available information, and direct their actions towards choosing the best alternative to maximize the outcome of their activity. This model is grounded in a series of theories that predict that economic individuals behave rationally and have profit maximization as their primary goal.

Rationalism, based on reasoned justification of the appropriateness and efficiency of economic decision-making, dominates the perception of humans as participants in financial relations over an extended period.

Behavioral finance studies, demonstrates, and explains the relationship between financial decisions and psychological factors influencing the behavior of participants in financial relations. This direction in financial science and practice advocates the position of bounded rationality of economic agents and thus calls into question the conclusions of rational expectations and efficient markets theories. Therefore, decision-making in finance cannot be explained solely by analyzing rational behavior within formalized rules.

The behavioral approach in finance explains the irrational behavior of individuals when making financial decisions by combining knowledge from psychology and financial science. This concept allows for the examination of economic phenomena and processes from the perspective of irrational behavior of economic agents [11].

The theoretical foundation of the concept of behavioral finance was established thanks to the contributions of American psychologists Leon Festinger and Herbert Simon, who are considered the founders of this approach. It was further developed and systematized by the works of V. de Bondt, R. Thaler, H. Shefrin, and M. Statman, who significantly advanced and formalized the concept of behavioral finance, giving it the status of a scientific theory.

In 1957, Leon Festinger formulated the theory of cognitive dissonance, which asserts that when a situation does not align with a person's expectations, they experience cognitive dissonance with their own beliefs. Often, instead of changing their perspective, individuals resort to manipulating facts. Such a person, after making an incorrect and financially detrimental decision, may not acknowledge their mistake. Instead, they engage in self-deception and shift responsibility onto others.

Herbert Simon, another American psychologist, is renowned for his research on the limitations of human intelligence in decision-making, which is attributed to the limited number of neurons in the human brain. He proposed a model of decision-making processes known as "bounded rationality" and was awarded the Nobel Prize in Economics in 1978 for his work on decision-making processes in economic organizations.

The modern concept of behavioral finance, once again linked to psychologists Daniel Kahneman and Amos Tversky, further evolved. In their work

on "Prospect Theory," they demonstrated that the incorrect perception of information can lead to erroneous judgments and irrational human behavior. In Kahneman's "Theory of Prospects," he noted that people make decisions based on expectations of an uncertain future. His theory was supported by American research, and Kahneman himself was awarded the Nobel Prize in Economics in 2002.

According to Kahneman, people react differently in situations where they win or lose, often incorrectly assessing the probabilities of events due to their own feelings and stereotypes. For example, an individual may be more sensitive to losses than to gains [12].

Additionally, a person's decision-making can depend on how information is presented to them regarding a theory, phenomenon, or object. This technique allows influencing a person's consciousness and directs their thinking in a specific direction, leading to the adoption of the "correct" decision.

Recent research in the field of behavioral finance conducted by R. Thaler, H. Shefrin, and M. Statman focuses on the influence of psychoemotional factors on the behavior of investors, the value of securities, and the returns investors will receive. The functioning of financial markets, including currency and stock exchanges, confirms that investors are not always rational. Scientists point out the presence of the "herd effect" on financial markets - a collective influence that arises through an "information cascade" as another behavioral bias [13].

Irrational behavior of individuals also manifests through the "illusion of control" and the associated "excessive optimism and overconfidence effect," which lead people to overestimate their ability to predict market developments when making financial decisions.

Overall, there are many subjective factors that trigger and provoke irrational investor behavior in the market. These factors may be related to a mistaken perception of reality or a misjudgment of the actual situation, or they may be purely emotional characteristics inherent in human nature that influence people's behavior. Among these factors, both science and practice highlight various "effects" and "paradoxes," including the "anchoring effect," "conservatism effect," "competence effect," "trap effect," "Allais paradox," and others. These effects, which explain many factors of irrational behavior among financial market participants, as well as other research findings and scientific theories based on them, have contributed to the emergence of behavioral finance as an independent field.

The modern concept of behavioral finance is closely linked to medical studies of the human brain and has led to the development of neuroeconomics and neurofinance. According to the results of research conducted by scientists, the frontal part of the brain is responsible for making rational decisions, while the upper and rear parts of the brain are associated with stereotypical (irrational)

decision-making. In practice, most financiers make irrational decisions, but in non-standard situations, there can be observed high brain activity in the frontal part of the brain [11].

Scientists, conducting experimental research, have concluded that irrational behavior, once considered solely deviant and random, is actually widespread, especially in conditions of uncertainty. When normal modes of functioning fail and uncertainty becomes the dominant state of society, people may start to act from irrational motives. According to psychological studies, financial behavior can be a reaction to the socio-economic and political reality that does not promote optimism and contributes to the spread of distrust in various institutions, both political and financial.

The primary achievement of behavioral finance is the recognition that in the realm of finance, just as in other aspects of life, individuals make decisions influenced by societal stereotypes, perceptual illusions, biased thoughts, information analysis errors, and emotions. Research in behavioral theories has allowed the identification of a list of factors that influence financial decisions (table 1).

Table 1 - Behavioral factors that influence financial decision-making

Name of the factor	Types of factors
1	2
Heuristics	Heuristics of representativeness Availability heuristics "Anchoring" heuristic The effect of joining the majority
Emotions	Optimism Pessimism Mood Excessive self-confidence The effect of pity The illusion of control
Framing (the framing effect)	The tendency to react to a certain choice in a different way depending on the context, the formulation of the problem or proposal, that is, how such a choice is presented - as a loss or a win

Continuation table 1

1	2
Market influence	Post-acquisition rationalization Confirmation bias Illusion of frequency Fundamental attribution error (FFA)
Psychological accounting	The tendency to treat money differently depending on where it came from, in what form it is stored and what it is spent on
Loss aversion	Willingness to take greater risk to avoid loss than to gain additional income The status quo effect Possession effect Trap effect Ostrich effect

The primary concept of cognitive bias theory is that individuals create their own subjective reality based on the perception of external information, which can influence their behavior. Cognitive biases can lead to distorted perceptions, inaccurate judgments, illogical interpretations, or "irrationality." Cognitive biases encompass heuristic methods, effects, emotions, framing, and market influence.

In contemporary conditions, where individuals are constrained by time and resources for decision-making, optimal analysis of available data becomes challenging. To expedite responses to external stimuli, simplified algorithms known as heuristics are created. Heuristics are shortcuts that simplify complex information processing methods required for decision-making. However, making financial decisions based on heuristic simplifications often leads to systematic errors and biases [7].

Let's consider the main types of heuristics that influence the process of making financial decisions:

1) Representativeness Heuristic: This heuristic implies that people assess the probability of an event based on its similarity to stereotypical or typical cases. In other words, when people encounter new information or a situation, they usually compare it to their conception of what a typical case should be like and make conclusions about the event's probability based on this comparison. This can lead to a distortion of the actual probability of an event since stereotypical cases may not accurately reflect the real situation;

2) Availability Heuristic: The availability heuristic involves people's tendency to make conclusions based on the information and images readily

available in their memory. This means that people often consider what easily comes to mind as more likely or correct, regardless of how accurate or comprehensive it is. This heuristic can lead to incorrect conclusions since the information may be insufficient, distorted, or biased;

3) Anchoring Heuristic: The anchoring heuristic involves individuals assessing a particular situation based on previous information or numerical value ("anchors") that was presented earlier. This effect can be used for commercial purposes, for example, when three product options with different prices are offered: very expensive, medium-priced, and very cheap. Individuals tend to choose the medium-priced option, which may appear more favorable compared to the others, but in reality, it may be less advantageous than other alternatives;

4) Herd Behavior Effect: The herd behavior effect, also known as the "herd instinct," involves the tendency of people to act or believe in something that is popular among many individuals. This may be related to the fear of being different, a desire to conform to the general consensus, or simply the habit of mimicking the behavior of others. Such behavior is typically associated with groupthink and the subordination of individual decisions to broader social dynamics.

Emotions also influence the decision-making process and can affect preferences and beliefs, including:

1) Optimism Bias: The ability of individuals to expect a positive outcome in the future, even when there are not enough rational grounds for such expectations. This effect is also known as the "positivity effect," where information that has a positive valence (i.e., perceived as pleasant) is more likely to inspire optimistic expectations.

2) Pessimism Bias: The tendency of some individuals, especially those suffering from depression, to overestimate the likelihood of negative events and to overly pessimistically assess their own capabilities.

3) Mood Effect: People tend to better remember information that aligns with their current mood. Recent research has shown that mood influences investment decisions and individuals' confidence levels in their skills and abilities.

4) Overconfidence Effect: This effect involves people frequently being overly confident in their answers to questions, even when they lack sufficient information. Recent studies indicate that when participants were 99% confident in their answers to certain questions, the accuracy of their responses was only 40%.

5) Illusion of Control: This is the tendency of individuals to believe that they have the ability to control or, at the very least, influence the outcomes of events over which they actually have no control.

6) Regret Aversion Effect: This phenomenon occurs when people avoid making decisions that could lead to negative outcomes due to the pain or regret they might feel for making wrong decisions in the past. One way to avoid the regret aversion effect is to shift responsibility onto other people [12].

Another psychological characteristic that can explain irrationality in financial decision-making is framing. Daniel Kahneman and Amos Tversky noted that the frame accepted by an individual consists of how a problem is formulated and the rules, habits, and personal characteristics of the decision-maker. In other words, people's preferences and decisions can depend on how a situation is described and the options presented.

A significant number of financial decisions are influenced by the market, based on factors such as brand loyalty and advertising:

1) Post-purchase rationalization, also known as the "Stockholm Syndrome of Purchasing," is a phenomenon where a person who has bought an expensive product or service fails to notice its flaws or defects to justify their purchase.

2) Confirmation bias is the tendency to seek and interpret information in a way that confirms one's own beliefs or hypotheses. Experiments have shown that this bias can lead to overconfidence in one's strategies, disregarding evidence that these strategies may result in financial losses, which is particularly relevant for investors.

3) The illusion of frequency or recency reflects a situation where a word, name, or other object that recently drew attention seems to occur exceptionally frequently afterward. This effect is also known as the Baader-Meinhof Phenomenon. The phrase "I've heard about this recently" typically indicates the presence of this phenomenon.

4) The fundamental attribution error is a tendency to overestimate the role of personal characteristics in explaining the behavior of other people and to underestimate the influence of the situation on the same behavior. This can lead to various other attribution errors, such as the actor-observer bias, the group attribution error, the positivity effect, and the negativity effect.

Psychological accounting, developed by R. Thaler, suggests that people treat money differently depending on its source and location. For example, people are more likely to spend money they've won at a casino, in a lottery, or found, compared to money they've earned through their work. Additionally, the use of credit cards can create a sense of security in people, which can lead to excessive spending. These biases result in people assigning different values to the same money, depending on its origin and allocation, even though rationality dictates that all money should be treated equally.

The Prospect Theory, developed by D. Kahneman and A. Tversky (1979), describes how investors perceive profit and loss. This theory establishes that people view gains and losses differently, and that it is harder for an individual to accept losses than to celebrate equivalent gains (loss aversion). Losses always appear more significant than income. The theory also demonstrates that people are more willing to take on greater risk to avoid losses than to receive an additional reward for taking on more risk. Investors may hold onto depreciating stocks while selling those that are increasing in price, rationalizing it with the belief that prices

will rebound in the future. The Prospect Theory leads to the paradoxical conclusion about how people perceive gains and losses.

The non-acceptance of losses is one of the universal and highly significant aspects of human behavior that can explain many behavioral phenomena, such as the St. Petersburg paradox and the status quo effect. It can also account for the endowment effect, which is the tendency to assign high value to items solely because a person possesses them. Non-acceptance of losses is a fundamental feature of human behavior, which may have evolutionary origins, as supported by research on capuchin monkeys [12].

Let's provide a description of types of behavioral factors related to the non-acceptance of losses:

1) the effect of the status quo is a tendency to maintain and satisfy the current state of affairs, instead of moving to new solutions or alternative options. For example, this can be observed in the behavior of people, regarding the choice between the current system of pension insurance and the new, non-state system, which is used in many countries of the world. Most people prefer a familiar and familiar system to a new and unknown one;

2) the possession effect is a theory that people value things more simply because they own them. They are willing to pay more for something they already have in their hands than for the same thing that belongs to someone else, even if there is no particular attachment to the thing. This effect can be explained by the value function of loss aversion: the desire to buy or sell something depends on whether a person has that thing now. That is, if a person owns some thing that has value for him, then the selling price will be equal to the level of regret he feels at the loss of this thing. And if a person wants to buy something, then the price will be determined by the level of satisfaction from its purchase. However, these levels differ because losing is more regretful than buying is satisfying;

3) the trap effect is a phenomenon when an economic agent invests funds, time and effort in a project that does not achieve the expected results or does not develop, but continues to invest resources in the project in order to return the initial investment, despite the increase in failures and losses;

4) the ostrich effect is a tendency to avoid possible risky financial situations, preventing their existence. According to research, investors are more likely to prefer those financial investments about which there is no information about risk, than similar investments in terms of return and risk that are regularly reported [12].

In conclusion, we can conclude that the behavioral approach in finance emphasizes psychological factors that are key to explaining many aspects of a person's financial behavior. The use of psychological factors in economic analysis complements the conclusions of traditional economic theory, provides more complete information about the peculiarities of human behavior and allows to

better explain the processes occurring in individual decisions of the population. It deepens the understanding of people's behavioral strategies in modern financial science and becomes an increasingly important element for the development of financial markets. Thus, behavioral finance is based on a cumulative institutional basis in the theoretical plane and becomes a catalyst for the development of financial markets in practical application.

Today, the financial culture of the population is a key factor in building a prosperous society, strengthening financial markets and accelerating investment processes. However, the most important is the role of financial culture in the intelligent management of personal finances, which makes it possible to increase the well-being of citizens. Financial culture means that people have the ability to effectively manage their finances, make rational financial decisions in the short and long term.

In many countries of the world, various educational programs on financial literacy, courses on accounting and planning personal expenses, rational organization of financial flows of citizens and households, planning incomes and budgets, making investments, etc. are popular. Financial science abroad actively researches the basic principles of managing one's own finances, family accounting and activities to improve the financial literacy of the population. Such activities in the field of personal financial management are quite common in developed countries.

In developed countries, a practical economic culture of managing one's own finances was formed, which arose under the influence of historical factors, state policy and the professionalism of financial market participants. The level of financial culture and economic behavior of citizens in these countries is significantly higher than in Ukraine.

Perhaps it is useful for Ukrainian society and individual citizens to accept simple advice in the form of axioms for managing their own financial flows and constantly use them in practice. The basic principles of the system of managing a person's own finances should be the axioms of financial behavior, which, when summarized, help ensure the personal wealth and well-being of citizens [12].

Planning and managing personal finances is an important aspect of financial literacy. This includes the ability to manage personal finances, knowledge of different types of investments and the risks associated with them, the ability to plan a budget and spend money wisely.

First, it's important to always monitor your finances, which means keeping records of all your expenses and income. Today, the digitalization of society greatly facilitates the process of keeping financial records, and computerized accounting replaces routine and helps to avoid errors. This allows you to make the process of managing personal finances a more interesting and exciting activity, and

also gives the opportunity to have a complete picture of the financial situation at any time and to examine expenses for their effective control.

It is recommended to actively form the habit of regular accumulation of funds as the difference between income and expenses. Based on your own life experience, you can find different ways to significantly reduce costs without worsening the quality of life. To create a secure future, the practice of setting aside 10-15% of current income as savings is useful. This, together with cost control, allows you to get the maximum effect.

After certain savings have been made, it is desirable to consider investment opportunities to increase personal capital or protect it from inflation. Usually, savings are distributed among different types of investment instruments depending on the level of risk, for example, between bank deposits, securities, real estate and others [15].

In real life, it is important to protect your financial interests through risk insurance. In the insurance market of Ukraine, there is a large number of policies that provide a wide range of types of insurance to protect against unwanted events. Since personal funds often depend on many factors, such as health, natural disasters and high inflation, which are beyond the individual's control, insurance can be a productive way to preserve financial health.

One of the most important elements of personal finance management is personal financial planning and forecasting. This process is continuous and involves the planning and implementation of financial goals, as well as the efficient redistribution of income over time. To implement such planning, it is necessary to outline priorities, assess available and necessary resources, consistently determine and calculate the achievement of goals.

In the process of financial planning, it is also important to identify tools that will help track financial activities, make forecasts for the future and optimize cash flows. Thus, personal financial planning is the defining principle of the strategy of managing personal funds, which allows people to maintain control over their financial situation and achieve their goals [16].

One of the directions of planning and managing personal finances is creating a budget. Personal finance budgeting is the process of planning and controlling personal expenses and income in order to achieve financial goals. Budgeting allows people to better understand how they spend their money and helps them control their spending to avoid going over budget.

The basic steps of personal finance budgeting include.

1. Determination of income: First, you need to determine the total level of income, which includes all sources of income such as salary, dividends, investment income, etc.

2. Determining expenses: the next step is to determine all the expenses that a person plans to make during a certain period. These expenses may include bills for electricity, gas, water, food, clothing, entertainment, and more.

3. Budget planning: after determining total income and expenses, you need to allocate money to different categories of expenses. This can include housing, food, transportation, entertainment, and more.

4. Following the plan: Once the budget has been drawn up, you need to follow the plan and control your spending. This may include tracking costs to ensure they are not over budget and making changes to the budget if unforeseen circumstances arise.

Personal finance budgeting can be useful for anyone, regardless of income level. It allows individuals to increase their savings, reduce their debts and ensure financial stability [17].

Another area of financial planning and management is investment. People can invest their money in stocks, bonds, real estate, currency and other assets to grow their capital. However, before starting to invest, it is necessary to familiarize yourself with all the risks and opportunities.

Investment is a term that is often used in various fields of economics and finance because it is an extremely important multifaceted category that plays a significant role at both the macro and micro levels. Investments ensure the dynamic movement of financial flows in the most promising areas of activity, which promotes the development of innovations, supports entrepreneurial activity and is of critical importance for the development of society as a whole.

The functioning of the investment market is an integral part of the investment process, since it is on this market that assets are bought and sold, ensuring the circulation of investments. The investment market has its own conditions, the ratio of supply and demand, the level of competitiveness of issuers, as well as the level of volatility of asset prices, which affect the investment process. In addition, the investment process is associated with operational and systemic risks that may affect its performance.

The sources of investment financing are:

– own, borrowed and loan capital;

– population savings accumulated by financial intermediaries;

– funds that are centralized by associations of enterprises;

– investment fund and development budget funds;

– investment allocations from the state budget;

– funds received from the privatization of state property and the sale of state blocks of shares;

– foreign investments, presented in various forms and types [18].

Saving money is an integral part of the investment process. However, not all saved funds can be considered investments. For example, if the money is not used by the owner for current expenses, it can be considered savings. But if the money is not used to carry out any investment operations, then it is not an investment. Only those savings that are used to expand production for the purpose of

generating profit in the future, often some time later, can be considered an investment.

Investing is the process of placing money in various types of assets in order to increase your capital. Investments can be long-term or short-term, depending on the goals and needs of the investor.

The main areas of investment include:

1) shares are property in a certain company, which gives the right to a share in the company's profits and the opportunity to receive dividends;

2) bonds are a type of loan provided by an investor to a company or the state, which guarantees the payment of interest and the return of funds after the end of the loan term;

3) funds are investment funds that collect money from many investors and invest it in various assets, such as stocks, bonds, real estate, metals, etc.;

4) real estate is an investment in real estate that can be long-term and bring stable income from rent or sale;

5) currency – investing in different currency pairs can bring profit from exchange rate fluctuations.

Before starting to invest, you need to assess your risks and opportunities, research the market and choose a suitable type of investment that meets your goals and needs. It is also important to remember that investing involves the risk of losing money, so you must be prepared for such possibilities and thoroughly study all aspects of investing before starting the process [18].

The third area is retirement planning. People should think about their retirement and start planning for it as early as possible. One of the most important aspects is knowledge about the pension system that operates in the country, as well as the possibility of private pension provision.

Retirement planning is an extremely important aspect of financial planning for the future. Understanding the pension system that operates in the country is a key factor in financial planning for the later years of life. In addition, it is worth considering non-state pension options, which can help ensure financial stability in retirement. Non-state pension insurance is an insurance system that allows you to personally provide yourself with additional pension income for the future, in addition to the pension from the state. In this system, individuals or their employers make certain payments to a non-state pension fund, which then invests these funds in various instruments (stocks, bonds, real estate, etc.) in order to increase their value. At some point in the future, when a person needs additional retirement income, they can receive payments from this fund. Non-state pension insurance is one way of securing future pension stability and can be useful for those who do not want to rely solely on a state pension. The earlier a person starts thinking about retirement and starts planning it, the more opportunities he will have to ensure a comfortable old age [18].

The fourth direction is credit and debt management. One of the important aspects of financial literacy is credit and debt management. Using credit can be useful for achieving financial goals, but it is important to understand that credit is not free and you need to know how to use and repay it correctly. Debt settlement should be seen as a long-term strategy in which you need to plan your expenses and find ways to reduce your debts to ensure financial stability in the future [19].

The rational paradigm of finance combines a number of financial theories that illustrate the sequence of financial decisions, assuming that the economic person is a rational and motivated participant in profit maximization. Theories of rational finance determine that the financial decision is theoretically optimal, but they do not reflect the real choice of the market participant and do not take into account psychological motives, expectations or selective acquisition of information. At the same time, behavioral theories prove that a person uses two parallel decision-making systems: the first is fast, automatic, intuitive, forced, which is influenced by various heuristics and generates impressions, guesses, previous judgments, and the second is slow, reflective, controlled , conscious, logical, which requires effort and filters the solutions of the first system. The first system has a predominant influence on how people make decisions, and its dependence on heuristics can lead to systematic errors.

It is impossible to change most of the behavioral factors studied in scientific work, however, it is possible to reduce their influence on the process of making financial decisions. Speaking about strategies for reducing the impact of behavioral errors (debiasing strategies), Larrick (2004) suggested that behavioral errors have several determinants, and it is unlikely that simple causes can be found and a clear correspondence between each specific such error and strategies for reducing its impact is unlikely [9].

The ability and ability of households to choose the most expedient and optimal financial decision-making strategy devoid of behavioral influence is extremely important. However, in order for the population to be able to make effective financial decisions, they must have knowledge not only in the field of finance, but also know about the human tendency to make certain systematic errors and be able to correct their irrational behavior.

According to scientists, there are several factors that prevent people from learning from their mistakes and correcting their behavior if the suboptimalness of the decision made is obvious:

– people do not know much about the role played by the intuitive (illogical) system in decision-making and underestimate the scale of defects and the depth of their behavior's tendency to make mistakes. As a rule, the decision is evaluated by the result, and not by the quality of the process of its adoption. For example, if a bad investment decision led to a positive result due to a lucky chance, then most likely the investor will repeat it again in the future;

– feelings of regret (regret), cognitive dissonance, sunk cost fallacy, status quo effect and inertia reduce the likelihood of admitting one's mistakes and, accordingly, reduce motivation to change behavior [9].

It would be good if households independently took up arms and learned to avoid all the negative consequences of behavioral factors, but without serious efforts and self-education it is extremely difficult to do this [1]. And, taking this into account, the public policy of countries that care about the welfare of their population should be based on such strategies that can reduce the influence of behavioral factors and help the population avoid many mistakes.

We propose to consider two strategies, which, in our opinion, are the most effective.

The first is a strategy based on the principles of libertarian paternalism. Well-known American scientists, Nobel Prize laureates in economics - R. Thaler and his co-author K. Sunstein, in their book "The Push" first proposed the idea of libertarian paternalism.

Libertarian means freedom of choice, paternalism means influencing people for the purpose of healing, improving, and prolonging life [6].

Libertarian paternalism is a strategy that encourages people to make optimal choices dictated by reason rather than feelings or momentary desires [20]. Under such paternalistic governance with libertarian means, individuals will tend to make right decisions rather than wrong ones. It is especially important to do this when concluding agreements regarding health or pension insurance, making savings, consumption or choosing loans, etc.

Understanding human motivation and the peculiarities of decision-making by people helps to increase the effectiveness of management, to find the right words that can motivate individuals and groups. Currently, "soft", "intelligent" methods of state regulation are becoming popular all over the world, which in many areas, as a rule, turn out to be more effective than "hard". They are based on the achievements of modern psychology, economics, sociology and other social sciences. In addition, they are more humane. Such methods are also called behavioral, or "pushing". The main role in their appearance was played by the ideas of behavioral economics.

It is clear that the market economy, which is based on the action of competitive forces, automatically solves problems related to the provision of private goods, but on the other hand, private producers have an incentive to use manifestations of human weaknesses to their advantage (selling alcoholic beverages, cigarettes). In such cases, state intervention is necessary. The state can be the architect of choice, pushing citizens to behave rationally [21].

The "architects" of choice can be both the state and the private sector. The ten most common nudges according to K. Sunstein are known: default rules; simplification; use of social norms; relief; convenience; disclosure of information; pre-agreed strategy; reminder; pre-expressed intention; informing people about the consequences of their previous choices.

The "nudge" method was appreciated by the leaders of world states (USA, Great Britain, France), creating "Nudge-Units" - institutions that practically introduce the latest findings of behavioral economics into public administration. Measures implemented by such an agency during 2009-2012 saved the US government about $90 billion [22].

Let's consider in more detail the experience of using this method on the example of some states.

Great Britain is the first country in which a nudge unit was established. At the same time, during the six years of its existence, this body has changed its status and is now essentially an international company that provides consulting services to the governments of various countries regarding the application of behavioral economics approaches in state regulation. Initially, the Behavioral Insights Team was established in 2010 as a unit of the UK Cabinet Office to review the state's position on behavioral aspects of public policy. As an independent unit, it produces proposals for behavioral approaches, as well as issues methodological recommendations for the application of such approaches in the work of other state bodies. The main forms of interaction between the group and state bodies are consulting on possible application of behavioral methods and participation in a number of projects. In most cases, the group conducts controlled experiments (randomized controlled trial) in order to determine the effect of one or another mechanism on the objects of regulation. Currently, a number of government agencies in Great Britain are independently applying the methods of behavioral economics in their work, including by creating their own nudge units [5].

In Denmark, as in many European countries, there is no single state body for developing proposals in the field of behavioral economics. Some Danish state bodies are independently forming units to develop proposals in the field of behavioral economics. Since 2016, about 15 state bodies have participated in the process of applying behavioral economics, in which separate units for behavioral economics were created or they were in the process of creating such [5]. In terms of the application of behavioral economics methods, a distinctive feature of Denmark is the presence of non-governmental organizations that promote the use of the "nudge" method both in commercial structures and in government. Such organizations include the Copenhagen Behavioral Economics Network, the Danish Nudging Network, and the non-profit organization iNudgeYou. Simultaneously with the development of non-profit organizations in the field of behavioral economics in Denmark, there is an educational program on behavioral economics for civil servants. The purpose of training civil servants is to develop skills in identifying areas of public administration in which behavioral methods can be applied [5].

In the USA, two stages of implementation of behavioral methods in public administration can be distinguished. In the first phase (2009-2015), there was no separate body responsible for advising on behavioral economics, and behavioral

methods were embedded in the rule-making process. To clarify the application of the approaches laid down in Decree No. 13563, a separate body (the Office of Information and Regulatory Affairs of the Administrative and Budget Office of the Administration of the President of the United States) issued a Methodology for executive authorities on the use of information disclosure and simplification of information submission as regulatory methods. In addition to facilitating the perception of information in public policy, the method of standard selection can be used, when the answer that is most beneficial from the point of view of the goals of the program is accepted as the default answer. At the second stage, the model underwent changes. In 2014, a decision was made to create a separate structural unit responsible for the implementation of "pushing" in all spheres of state policy. Such a unit was the Social and Behavioral Sciences Team, created as a subcommittee of the National Science and Technology Council. Since 2016, a methodology has been released, using it, agencies can implement behavioral economics approaches in their work - information disclosure, choice architecture, etc. At the same time, practical recommendations are supported by scientific evidence about the behavior of citizens. For example, research in the field of behavioral economics has proven that a person's perception of information and reaction to it depend on the way it is presented. In this regard, agencies are advised to submit information in the form that would be most meaningful to the target audience [5].

National authorities, as well as supranational governing bodies, are constantly searching for tools to increase the efficiency of state regulation and increase general well-being. Numerous studies by behavioral scientists show that as an alternative to classical methods of state regulation, as well as in addition to them, non-standard and at the same time promising mechanisms of behavioral incitement can be successfully applied.

The expediency of the development and application of these methods in the practice of public administration is justified, first of all, by the fact that if traditional regulatory tools are based mainly on the idea of the rational thinking of individuals, then behavioral tools open up a new resource for increasing the efficiency of the development and implementation of state sectoral (sectoral) policies , which takes into account the influence of psychological factors and cognitive biases inherent in people. In addition, in many cases, the costs of using such tools are low, which allows you to use them with lower costs to achieve the tasks.

The range of forms of application of behavioral methods in regulatory policy is very wide. Nudging is already widely used in the form of quality public information to ensure informed decision-making, which is especially important in cases where mistakes can have significant negative consequences.

Advertising campaigns help sellers of goods and services to form or develop certain desires in a person and, thanks to this, push him to spend money on

such products. The development of digital technologies has given impetus to the development of targeted digital advertising. When using the Internet, a person leaves a lot of information in the digital space, which companies can use to analyze the needs, interests and preferences of a person and offer him, as a potential consumer, certain goods and services.

Experiments by scientists show that many people are psychologically ready to pay different amounts for the same product or service depending on where they are purchased. For example, for buying a bottle of Coca-Cola in a nearby store or bar of an expensive hotel. Or, as the researchers found out, some married couples can think long and carefully about which car to buy, but at the last moment change their choice and make a completely unexpected purchase.

However, often the method of "pushing" is also used to manipulate public consciousness, which marketers and political technologists have been using for many years. For example, a special arrangement of goods on the shelves: the buyer still has a choice, although some products (more profitable for the seller) will be closer. Carts for products are specially increased in size so that the buyer fills it with a large number of purchases. How ethical it is to use music and smells in the sales hall to create a certain mood in the buyer is also a big question.

In order to encourage people to be more environmentally responsible and throw away garbage, Danish behavioral experts have identified green-painted shoeprints going to the bins on the streets of Copenhagen. This led to the fact that people began to throw away much less garbage in unauthorized places, leaving it in designated bins. This experience of "green" pushing was successfully repeated in other countries.

It should also be noted that the methods of soft paternalism are applicable to encourage individuals to make effective decisions, not only economic, but also of a different nature (for example, encouraging people to lead a healthy lifestyle, sorting garbage, etc.).

The second strategy that helps citizens reduce the impact of behavioral factors is measures to increase the financial literacy of the population in the country. Education is an important factor that influences financial decisions. K. Christiansen (S. Christiansen) and his colleagues came to the conclusion that individuals with higher economic education are more likely to invest in the stock market, and another group of scientists proved that higher education (economics, business management or information technology) is associated with a higher (risk-adjusted) return. Also, it was established that education reduces the impact of some behavioral errors, from self-attribution to the disposition effect, and also affects the trading activity of investors [9, 5].

Every year, the number of countries in the world that adopt and implement programs to improve the financial literacy of the population is growing. In particular, in Europe, there are more than 180 programs for improving the financial literacy of the population [48]. Successful national programs were developed and are being implemented in the USA, Great Britain, Germany and Austria, and

among the countries where the formation of market relations took place not so long ago - in Bulgaria, Slovenia and Poland. Most countries have voluntary programs that offer financial education through various formal and informal educational programs. The most financially literate countries are Denmark, Norway, Sweden, where 71% of the population is financially literate, in Ukraine this figure is 40% (fig. 2).

In recent years, Ukraine has cooperated with various international experts and programs that help increase the level of financial literacy. This is a collaboration with the World Bank, the United States Agency for International Development, and the USAID project, within which research was conducted in the field of financial literacy of Ukrainians, as well as a strategy for improving financial literacy and special courses for schoolchildren were developed.

Many Ukrainian authors have appeared in the domestic scientific and elementary literature, who research the basics of managing personal finances, and since 2010, the optional course "Financial Literacy" has been introduced in schools. Also, the National Bank of Ukraine, universities, schools, public organizations help increase the financial literacy of the population by holding seminars, lectures, trainings, etc. The following educational campaigns are held annually: Savings Day, All-Ukrainian Financial Literacy Week, Global Money Week. In 2018, more than 150,000 Ukrainian pupils and students were covered by the Global Money Week events [15].

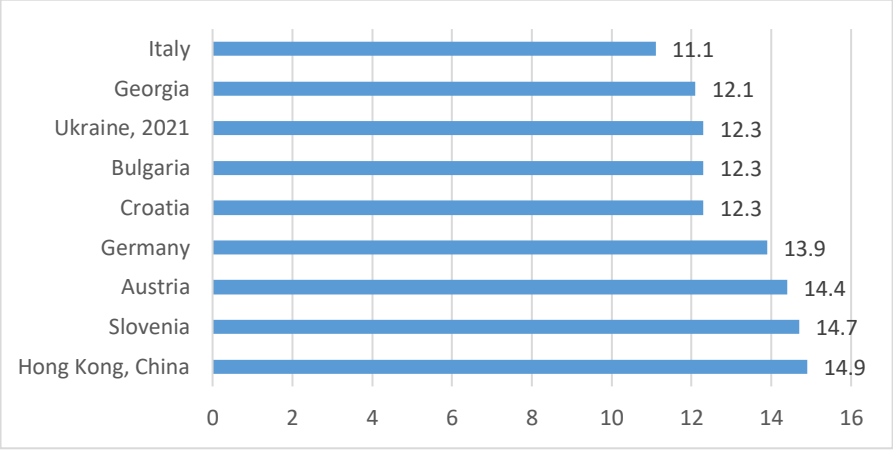

Fig.2 – Index of financial literacy: comparison with other countries

On September 23, 2023, the National Bank of Ukraine implemented the Educational site "Okay" - it is a free online platform for raising financial awareness and protecting the rights of clients of financial institutions. On the free online

platform, Ukrainians will be able to obtain a level of financial knowledge sufficient to make responsible decisions regarding personal finances.

The structure of the online platform consists of six sections: "Money", "Financial Planning", "Deposits", "Loans", "Fraud" and "Insurance". The site also has two special dynamic sections: "Life Hacks" and "Questions of the Day".

The website "Okay" was created by the National Bank of Ukraine with the support of the International Finance Corporation (IFC) within the framework of the four-year technical assistance program "Financial Inclusion for Economic Growth", which is implemented in partnership with the Swiss State Secretariat for Economic Affairs (SECO) and the Fund for Effective Management of the Government of the Great of Britain in Ukraine (GGF).

Extensive experience in developing financial literacy around the world at Visa Inc., which set a goal to help 25 million people acquire financial literacy skills by 2015. For this, Visa created a special financial literacy site, including materials on budgeting, savings, banking services, the use of bank cards, debt management, security in the use of cards, etc. In addition, the site presents a variety of financial games.

The results of the study conducted by the OECD on the effectiveness of financial education in the USA showed that among employees who have passed these programs, there is an increase in the rate of savings and a decrease in the level of overdue loans [23]. In the Netherlands, in addition to the main target groups such as children and youth, the focus is on citizens with low incomes or without higher education. They are taught daily personal budget management using the Stay positive and Money Help programs, respectively. In Great Britain, the national financial literacy program is implemented in the following priority areas: young parents (New parents: Money Box); schools (Schools: Learning Money Matters); youth (Young Adults: Helping Young Adults Make Sense of Money); workplace program (Workplace: Make the Most of Your Money); informing consumers (Consumer communications); Online tools (Online tools); financial advice (Money advice) [22].

Poland's experience shows that the largest organization that has been developing and implementing financial literacy programs for more than 20 years is the "Kronenberg Foundation" in cooperation with Citi Bank. Their projects: improving the financial literacy of children, students, young entrepreneurs, women entrepreneurs. Since 2005, the largest youth program "My Finances" ("Moje finanse") has been introduced, the main task of which is to teach people to make the right financial decisions and constantly improve their knowledge in the financial sphere. Another national program developed in cooperation with Academic Business Incubators is the "Business Startup" project. This project teaches university students and graduates to turn business ideas into real business, thereby stimulating the country's entrepreneurial activity.

The School of Financial Literacy program implemented in Austria [24] demonstrates that children and youth aged 10 to 18 respond very well to financial literacy programs and easily grasp basic knowledge of financial concepts. The results of the OECD study of the effectiveness of financial education in the USA [56] suggest that among employees who have completed these programs, there is an increase in the rate of savings and a decrease in the level of overdue loans.

In such countries as Taiwan, Singapore, and Malaysia, children are encouraged to be financially literate by publishing books and comics for them, where the main characters, falling into various situations, show by their own example how to act and how not to act in a particular situation.

The experience of implementing financial education programs for adults shows that 1) it is difficult to educate adults if they do not have a specific need for education in the field of financial services; 2) although the nature of financial psychology often makes it difficult to choose optimal behavior, financial education can alert the learner to such dangers and suggest workarounds.

In the Netherlands and England, in addition to the main target groups such as children and young people, emphasis is placed on citizens with low income or without higher education. They are taught daily personal budget management using the Stay positive and MoneyHelp programs, respectively.

In Great Britain, the national financial literacy program is implemented in the following priority areas: young parents (New parents: Money Box); schools (Schools: Learning Money Matters); youth (Young Adults: Helping Young Adults Make Sense of Money); workplace program (Workplace: Make the Most of Your Money); informing consumers (Consumer communications); Online tools (Online tools); financial advice (Money advice) [21].

The world experience of implementing public financial literacy programs confirms the fact that the proper level of financial literacy of the population will contribute not only to raising the standard of living of citizens, but will also positively affect the state of the financial services market and promote the activation of investment processes in the national economy.

Determination of priority areas, tools and appropriate information support for the practical implementation of measures to increase financial literacy based on positive foreign experience will enable the state, higher education institutions and scientific institutions to start solving the problem of low financial literacy of ordinary Ukrainians as soon as possible.

It is necessary to take into account the imperfection of legislative regulation, the impossibility of organizing an effective system of independent consultation of the population throughout the country in the shortest possible time. To do this, it is necessary to improve the regulatory and legislative framework, promptly inform about changes in the legislation, about the issuance and revocation of licenses, cases of fraud, provide coordinates of services and persons that consider public complaints.

The population of Ukraine has a high level of education; however, unfortunately, there is a certain gap in the area of effective personal finance management, leading to their inefficient use and, in some cases, savings loss. Naturally, motivation and the required level of financial knowledge vary across different segments of the population. In particular, older individuals tend to have a certain distrust of financial institutions due to their unfortunate experience of savings loss that they accumulated during the times of the Soviet Union. On the other hand, younger people lack a certain life experience in managing personal finances and have an insufficient level of knowledge about how to achieve their own financial well-being.

Ultimately, the lack of financial literacy poses significant risks to personal finances when individuals make decisions regarding their investment in various investment funds. It is precisely the understanding of the principles of operation of the relevant financial instrument and a clear perception of one's rights and responsibilities that allows distinguishing an honest market participant from a fraudster and safeguarding one's money.

First and foremost, it is necessary to focus on defining objectives and selecting behavioral strategies capable of stimulating economic development based on modeling and analyzing results. The next step is to identify those cognitive skills that most individuals lack to implement the desired economically viable behavior due to the education and training system. Simultaneously, the construction of a choice architecture requiring the presence of proven effective incentivizing alternatives can be considered. All these processes should be accompanied by comprehensive normative and regulatory support at the institutional level, along with the implementation of economic stimulus programs, infrastructure provision, and rational planning.

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IMPLEMENTATION OF EU SUSTAINABLE DEVELOPMENT GOALS IN THE ECONOMY OF UKRAINE

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Introduction. In September 2015, the UN Summit on Sustainable Development was held as part of the 70th session of the UN General Assembly. This landmark event led to the adoption of a landmark document entitled Transforming Our World: The 2030 Agenda for Sustainable Development. In this document, 17 Sustainable Development Goals (SDGs) and 169 tasks were formulated, which became global guidelines for the development of UN member countries [1].

Ukraine joined this global process of sustainable development and established a strategic framework for its national development for the period until 2030. The main principle was the principle "Leave no one behind", which indicates the need to ensure equal opportunities for all citizens.

By decree of the President of Ukraine, the "Goals of sustainable development of Ukraine for the period until 2030" were adopted, which determined the directions of development for the country. The implementation of these Goals is important for Ukraine and includes such priorities as the health and well-being of the population, peace and security, economic development, social protection, a stable state, community development and many others.

The SDGs are not just a set of ambitious plans, they are systemically coherent and interdependent. Their goal is to address the causes of poverty and meet the universal development needs of all people. They cover economic development, social integration and environmental protection.

The Global Goals expand the overall spectrum of the Millennium Development Goals and cover new areas such as combating climate change, reducing economic inequality, stimulating innovation, supporting sustainable consumption and production, and ensuring peace and justice.

A special feature of the Sustainable Development Goals is their emphasis on concrete means of implementation, including the mobilization of financial

resources, capacity development and the application of technology, as well as the importance of information and institutions for achieving results.

The Government of Ukraine presented the Voluntary National Review "Sustainable Development Goals: Ukraine", which defines the main indicators and tasks for achieving the Sustainable Development Goals. This report takes into account global development guidelines, principles of sustainable development and internal public opinion regarding the future development of Ukraine [2].

Achieving the Sustainable Development Goals must include the integration of efforts for economic growth, social justice and sustainable resource use. This requires profound socio-economic transformations and new approaches to global partnership.

In September 2019, with the signing of the Decree of the President of Ukraine on SDGs for the period up to 2030, Ukraine undertook to adhere to the global goals of sustainable development and implement them nationally, taking into account the specifics of the country's development.

In 2020, the team of the independent analytical platform "VoxUkraine" conducted research on the achievement of the Sustainable Development Goals (SDGs) at the national and regional levels in Ukraine. This study aimed to assess progress towards these goals and identify areas where additional efforts are needed.

The results of the study indicate that Ukraine has made some progress in implementing the SDGs, but there are also serious challenges and unresolved issues:

1. Social justice and economic inequality: the study showed that Ukraine has problems with reducing economic inequality and ensuring social justice. Uneven access to education, healthcare and other social services remains one of the main problems.

2. Health and well-being of the population: progress in improving population health indicators is revealed, but it is also shown that there are certain challenges in ensuring access to quality medical care and solving public health issues.

3. Promoting a peaceful and justice society: the analysis points to the need for more effective measures to ensure peace and justice in Ukraine, particularly in the areas of human rights, access to fair justice and the fight against corruption.

4. Economic development: Ukraine has the potential for further economic development, but it is important to ensure sustainable growth and the creation of decent jobs. It is also important to develop infrastructure and industry.

5. Environmental protection: the study of this issue indicates the need to improve the state of the environment and take measures to combat environmental problems, in particular air and water pollution.

Ukraine has made significant progress and achievements in fulfilling the goals of sustainable development. However, there are numerous challenges and

tasks that still require attention and efforts. Ensuring greater social inclusion, economic growth and preservation of the environment are extremely important tasks for the future of Ukraine.

The State Statistics Service of Ukraine together with VoxUkraine and with the support of the United Nations Development Program in Ukraine conducted an assessment of the progress towards achieving the Sustainable Development Goals in 2021 (fig.1) [3]. The assessment was carried out based on the methodology developed by the United Nations Economic and Social Commission for Asia and the Pacific and as part of the Voluntary National Review on the Sustainable Development Goals. The results of the assessment show that Ukraine has taken a significant step towards achieving important social and economic goals in 2020, having started its journey in 2015. Among the main achievements, it is worth highlighting the fight against poverty and hunger, improving the state of public health, increasing the level of gender equality, ensuring access to clean water and proper sanitation, creating decent working conditions and promoting economic growth. These achievements lay the foundation for the sustainable development of cities and communities, the strengthening of peace and justice, as well as the development of strong institutions, which are important components for improving the quality of life of citizens and increasing Ukraine's influence on the international arena.

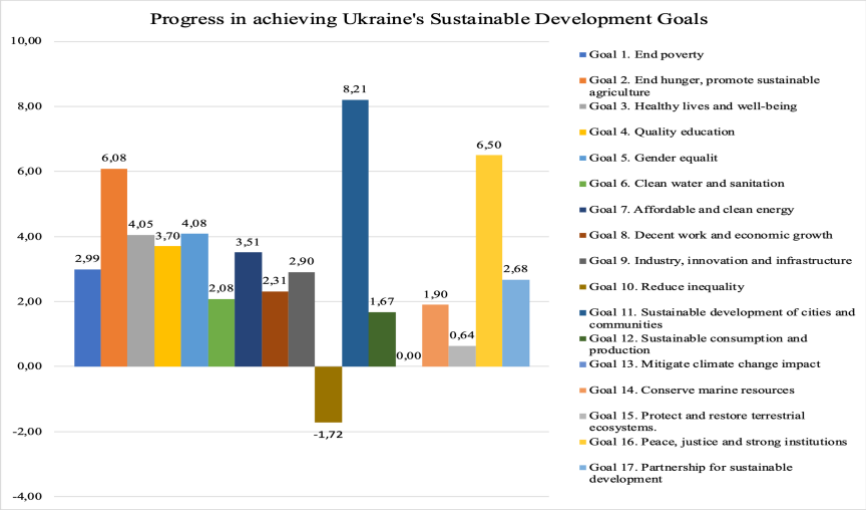

Fig. 1 – Progress in achieving the Sustainable Development Goals of Ukraine

Ukraine pays special attention to social and economic development, striving to improve the living conditions of its population and ensure sustainable economic growth. By continuing to work on these goals, Ukraine has the

opportunity to strengthen its position on the world stage and ensure the well-being of its citizens. Implementation of these strategic tasks creates positive prerequisites for further growth and prosperity of the country.

Given the importance of each SDG, let's consider them in detail:

Goal 1: Eradication of poverty

Eliminating poverty is one of the main goals of sustainable development. Ukraine has made some progress in reducing poverty in recent years. However, there are problems with high unemployment and low incomes in certain regions, particularly in rural areas and in the occupied territories. It is necessary to increase social support and attract investments to stimulate economic growth and reduce poverty (fig.2).

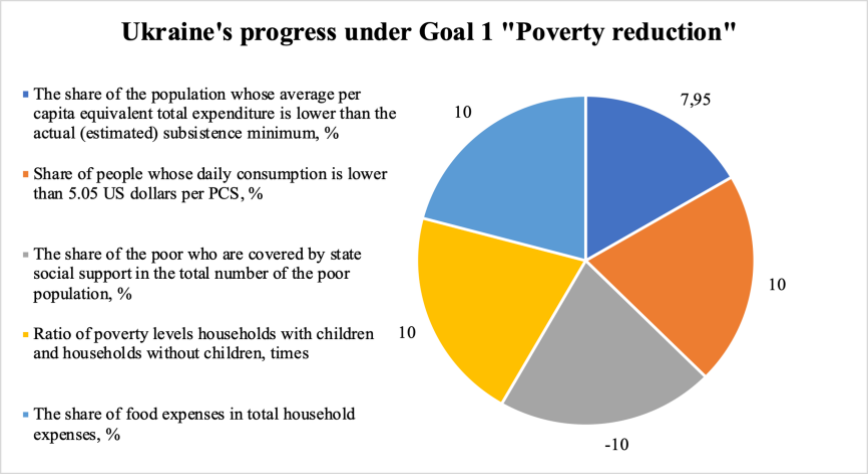

Fig. 2 – Ukraine's progress under Goal 1 «Poverty reduction»

Goal 2: Overcoming hunger and food security

Ukraine has a strong agricultural sector, but still faces challenges in ensuring safe and sustainable access to food. It is important to support agriculture, increase productivity and ensure product quality. It is equally important to develop programs of social assistance and nutrition for the most vulnerable sections of the population (fig.3).

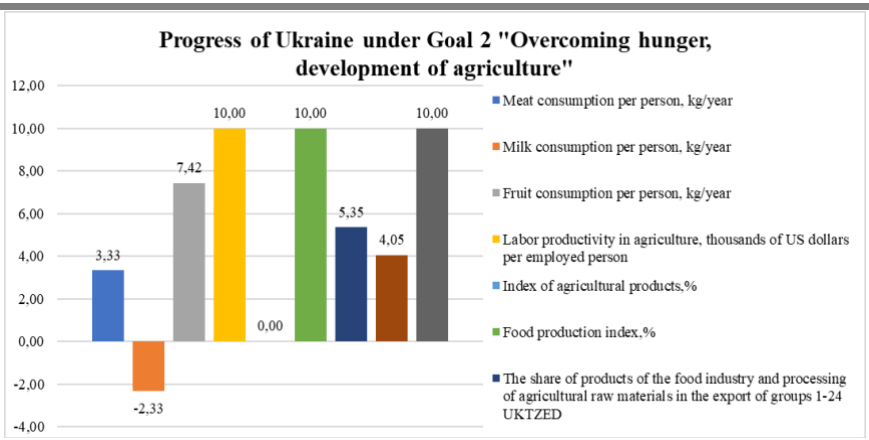

Fig. 3 – Progress of Ukraine under Goal 2
«Overcoming hunger, development of agriculture»

Goal 3: Health and well-being

The main problem in the field of health care in Ukraine is the low level of access to quality medical care and the lack of funding for the health care system. In particular, the health insurance system and access to quality medicines need reforms. Ukrainian society has a high incidence of some chronic diseases that require attention and preventive measures (fig.4).

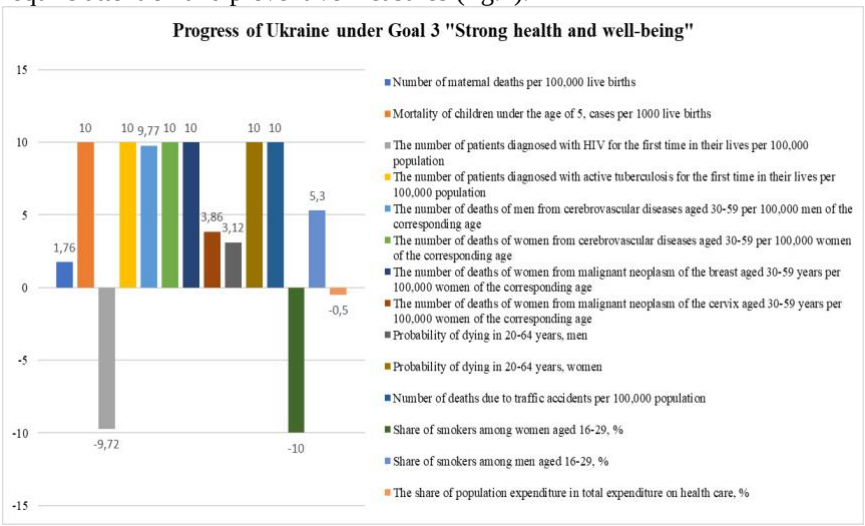

Fig. 4 – Progress of Ukraine under Goal 3
«Strong health and well-being»

Goal 4: Quality education

Education in Ukraine has improved in recent years, but challenges such as insufficient funding and low quality of education still exist. In particular, the possibility of lifelong learning expands the general intellectual potential, which helps to cope with modern challenges. Equal access to affordable professional education, elimination of gender and material inequalities and guaranteed access to education are important elements of achieving the goals of sustainable development (fig.5).

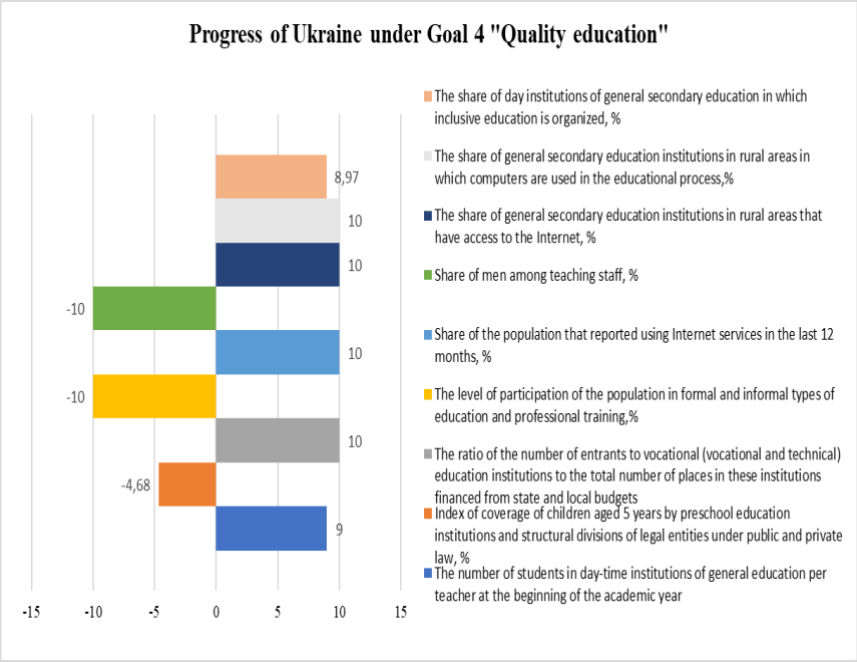

Fig. 5 – Progress of Ukraine under Goal 4 «Quality education»

Goal 5: Gender equality

Ukraine has a number of laws aimed at ensuring gender equality. However, certain stereotypes and cases of discrimination still exist in society, which prevent the achievement of full equality. It is important to continue to work on removing these obstacles and to actively carry out educational work to raise awareness of the importance of gender equality and expose stereotypes. In addition, it is important to ensure equal opportunities in all areas of life, including education, career development and participation in decision-making at various levels of society (fig.6).

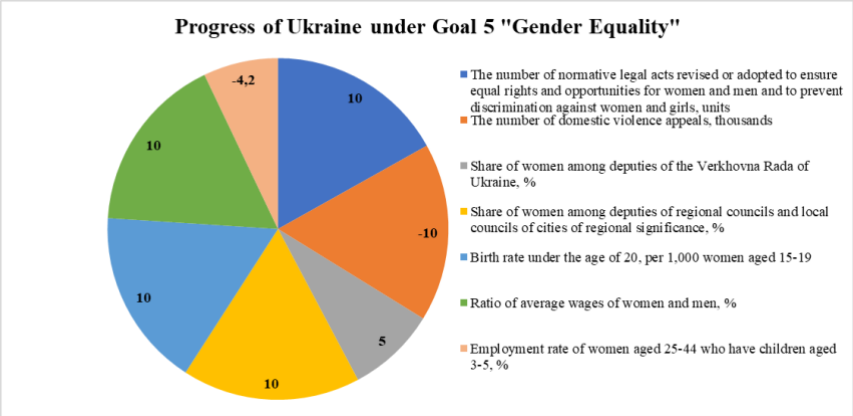

Fig. 6 – Progress of Ukraine under Goal 5 «Gender Equality»

Goal 6: Clean water and adequate sanitation

Ukraine has problems with providing clean water and sanitation for the entire population, especially in rural areas. Improving infrastructure and water supply is key to achieving this goal. Ensuring access to clean water is not only a matter of hygiene and health, but also an important component of sustainable development. This has a direct impact on people's quality of life, reducing morbidity, increasing productivity and overall community development (fig.7).

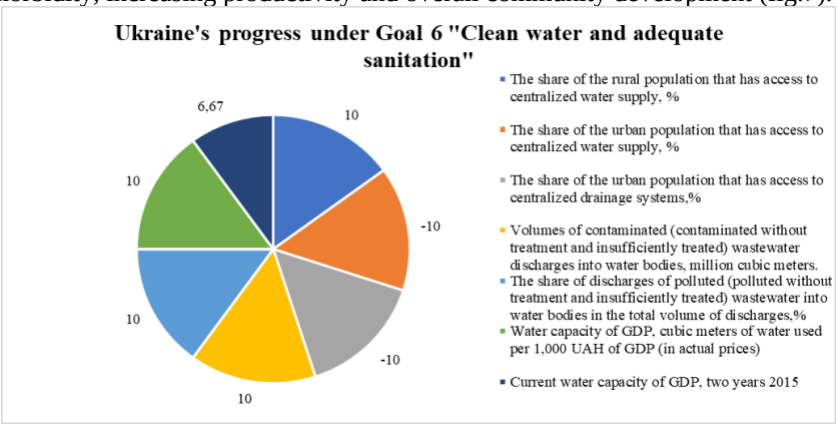

Fig. 7 – Ukraine's progress under Goal 6
«Clean water and adequate sanitation»

Goal 7: Affordable and clean energy

Ukraine is actively developing renewable energy sources, such as solar and wind energy. However, there are issues with energy efficiency and energy efficiency. To achieve greater sustainability and efficiency in the energy sector, it is important to reduce energy consumption in all areas, including industry, transport, and domestic needs. This can be achieved by modernizing the infrastructure and using more efficient technologies. Support for research and implementation of clean innovations in production and energy contributes to the reduction of emissions and environmental pollution. Improvement of the energy transmission and distribution system contributes to ensuring the stability and reliability of energy supply. Increasing attention to energy efficiency and the development of clean technologies are important steps to ensure sustainability and sustainable development of the energy sector in Ukraine (fig.8).

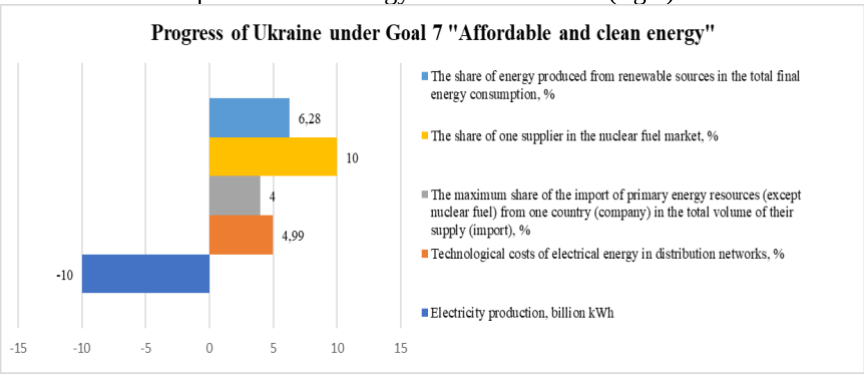

Fig. 8 – Progress of Ukraine under Goal 7 «Affordable and clean energy»

Goal 8: Decent work and economic growth

Economic development and improving the welfare of the population are extremely important aspects in the framework of the implementation of the Sustainable Development Goals. During the last decade, significant improvements in this direction have been noted in Ukraine. However, there are certain tasks that remain relevant, such as increasing labor productivity, introducing technological innovations in production, developing small and medium-sized businesses, improving their efficiency, reducing gender disparities in income and ensuring equal working conditions and opportunities for all, regardless of gender. age, nationality, etc. One of the main priorities for the state is raising Ukraine's rating in terms of business promotion and facilitating business conditions. Ukrainian companies are actively using the opportunities provided by the Goal "Decent work and economic growth" to implement their strategies in the field of human resources management. They focus on building the employer brand, improving the quality of working conditions, strengthening relations with their employees, and creating a corporate culture based on common values and goals (fig.9).

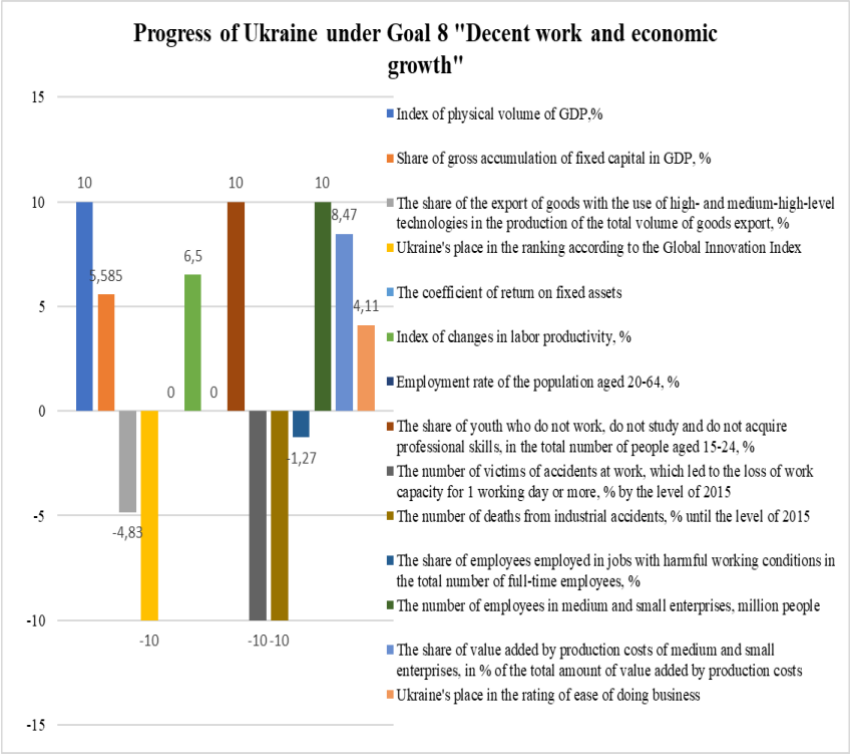

Fig. 9 – Progress of Ukraine under Goal 8
«Decent work and economic growth»

Goal 9: Industry, innovation and infrastructure

Ukraine has the potential to become an innovative leader in its region, but achieving this goal requires investment in research and development. Innovations can become an engine of economic growth and improvement of the quality of life of the population. A key component of success is the support of scientific research, the development of technological start-ups and cooperation between scientific institutions and business. In addition, the modernization of infrastructure and the development of the transport system are important steps to facilitate the exchange of goods and services. An efficient transport network promotes trade and supports economic development. Thus, investments in science, technology and infrastructure are important components of the strategy for achieving sustainable development of Ukraine and strengthening its position on the world stage (fig.10).

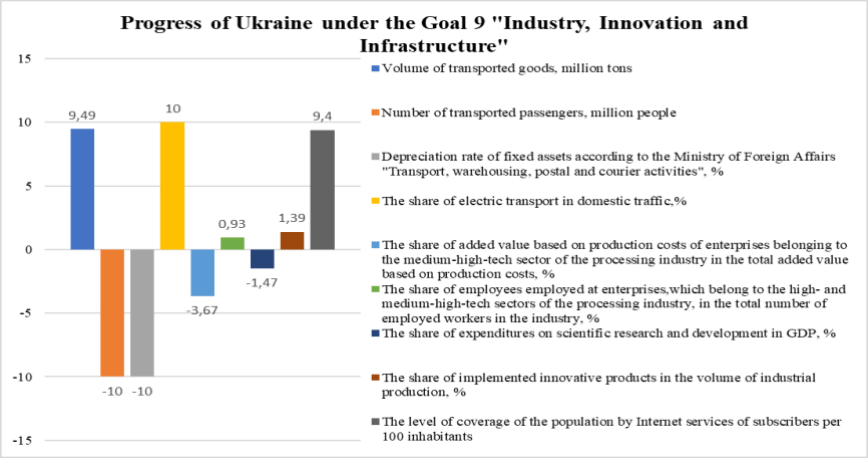

Fig. 10 – Progress of Ukraine under the Goal 9
«Industry, Innovation and Infrastructure»

Goal 10: Reducing inequality

Ukraine faces problems of inequality, especially between different regions and population groups. It is important to develop social support programs and promote the inclusion of all citizens in the processes of economic and social development. Goal 10 is key and has important implications for other aspects of the Sustainable Development Goals, such as poverty reduction, decent work and economic growth. Rising levels of inequality are largely linked to rural-urban disparities, discrimination based on gender, ethnicity, and inequality between indigenous peoples and migrants. Addressing issues related to reducing inequalities contributes to social justice and improving the quality of life for all citizens. Thus, Goal 10 is an important tool for creating a fairer and more equal society (fig.11).

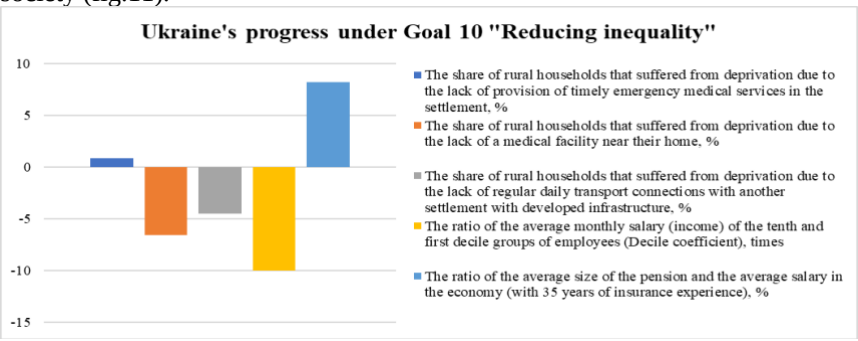

Fig. 11 – Ukraine's progress under Goal 10 «Reducing inequality»

Goal 11: Sustainable development of cities and communities

Urban planning and community development are important components of sustainable development for the country. Ukraine needs to actively improve infrastructure in cities and other settlements in order to improve the quality of life of citizens and ensure the effective functioning of facilities. This includes the construction and modernization of roads, the introduction of modern communication and transport systems, as well as the development of comfortable spaces for living and working. Ensuring the availability of public transport is a key aspect of urban development. A developed and convenient public transport system allows city residents to move easily and quickly, reducing the use of private vehicles and emissions of harmful substances. In addition, it is important to consider the environmental impact of urban regions. It is necessary to introduce environmentally friendly technologies and solutions to reduce emissions and environmental pollution. The development of green areas and parks contributes to the creation of a healthy and comfortable environment for citizens to live in (fig.12). Therefore, the development of urban planning and infrastructure in Ukraine is an important step on the way to achieving sustainable development and improving the quality of life of the population.

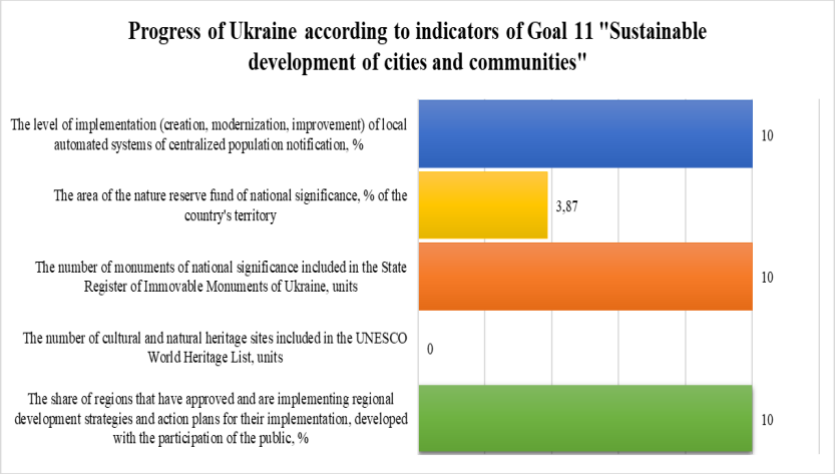

Fig. 12 – Progress of Ukraine according to indicators of Goal 11 «Sustainable development of cities and communities»

Goal 12: Responsible consumption and production

In Goal 12 "Ensuring sustainable consumption and production" Ukraine has its achievements and challenges. Ukraine joined international agreements and concluded its own agreements to limit the use of hazardous chemicals in production; Ukraine is actively investing in the solar and wind energy sectors to

reduce dependence on coal energy; Events and educational campaigns help raise environmental awareness among the population, which leads to more responsible consumption; Ukraine implements modern technologies and standards to reduce the negative impact of industry on the environment.

Despite a number of positive achievements, many areas of the economy need modernization and increased energy efficiency, which will reduce resource consumption. It is advisable to pay attention to the disposal and processing of waste in order to reduce the environmental burden. There is also a need to improve legislation and implement a control mechanism for effective regulation of the sustainable consumption and production sector.

Ukraine is actively working to achieve Goal 12 and implement sustainable consumption and production practices, concentrating efforts and solving the challenges facing the country (fig.13).

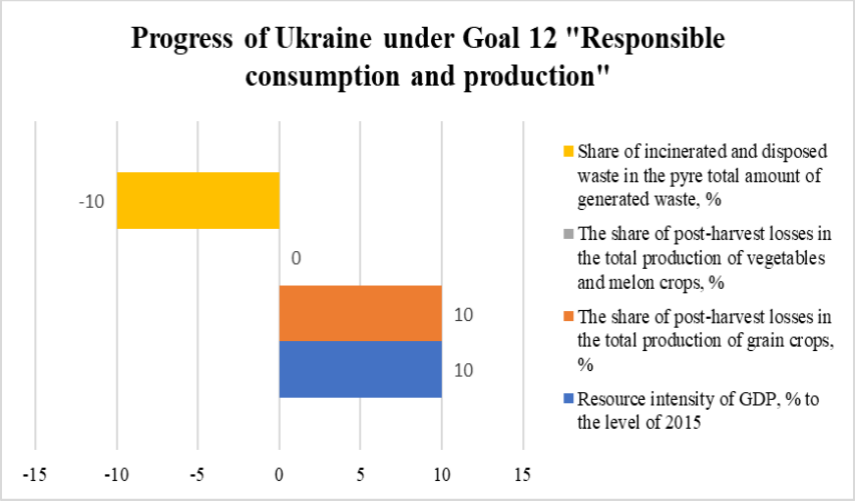

Fig. 13 – Progress of Ukraine under Goal 12 «Responsible consumption and production»

Goal 13: Climate change

Climate change is a global threat, and Ukraine should pay special attention to reducing greenhouse gas emissions and adapting to climate change. The development of renewable energy sources and energy conservation are important steps in this direction.

Goal 14: Conservation of marine resources

Ukraine has taken important steps in achieving the 14 SDGs. The country pays considerable attention to the protection of water resources and ensuring the population's access to clean water. Ukraine actively cooperates with international

organizations and partners to improve water management and protect the marine environment. An important step was joining the United Nations Convention on the Law of the Sea, which helps regulate the use and protection of marine resources. Ukraine is also actively working to reduce pollution of water sources and create sustainable marine and coastal ecosystems. The country is improving the wastewater treatment system, implementing programs for the conservation and restoration of aquatic biological resources, and monitoring the state of the marine environment. The country recognizes the importance of sustainable use and protection of marine resources for future generations and continues to work towards achieving this Sustainable Development Goal (fig.14).

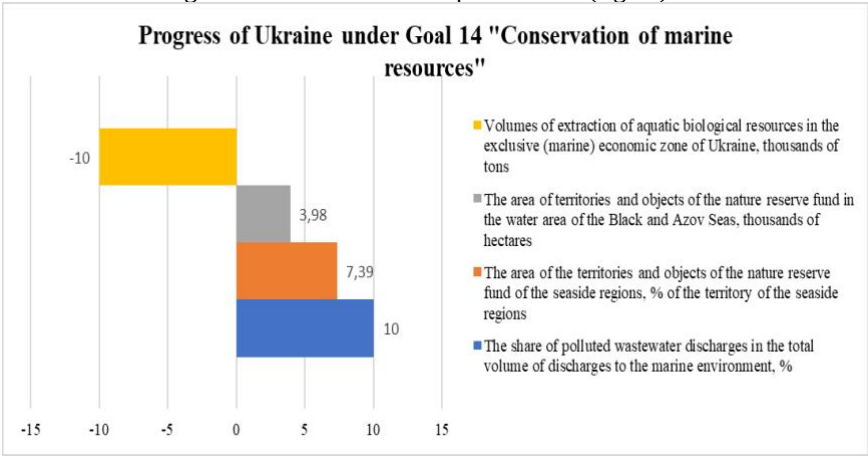

Fig. 14 – Progress of Ukraine under Goal 14
«Conservation of marine resources»

Goal 15: Protect terrestrial ecosystems

Protection of natural ecosystems and biodiversity is an important task for Ukraine, especially in conditions of growing pressure on natural resources, thus the country pays great attention to the 15 Goals of Sustainable Development, which is aimed at protecting ecosystems and preserving biodiversity. Measures are being taken in the country to restore and preserve forests, as well as combat landscape degradation. Achievements in this area include increasing forest cover, implementing programs to protect rivers and reservoirs, and promoting the conservation of rare species and their habitats. Ukraine develops scientific research and cooperates with international organizations to ensure sustainable use of natural resources and preservation of the natural environment for future generations (fig.15).

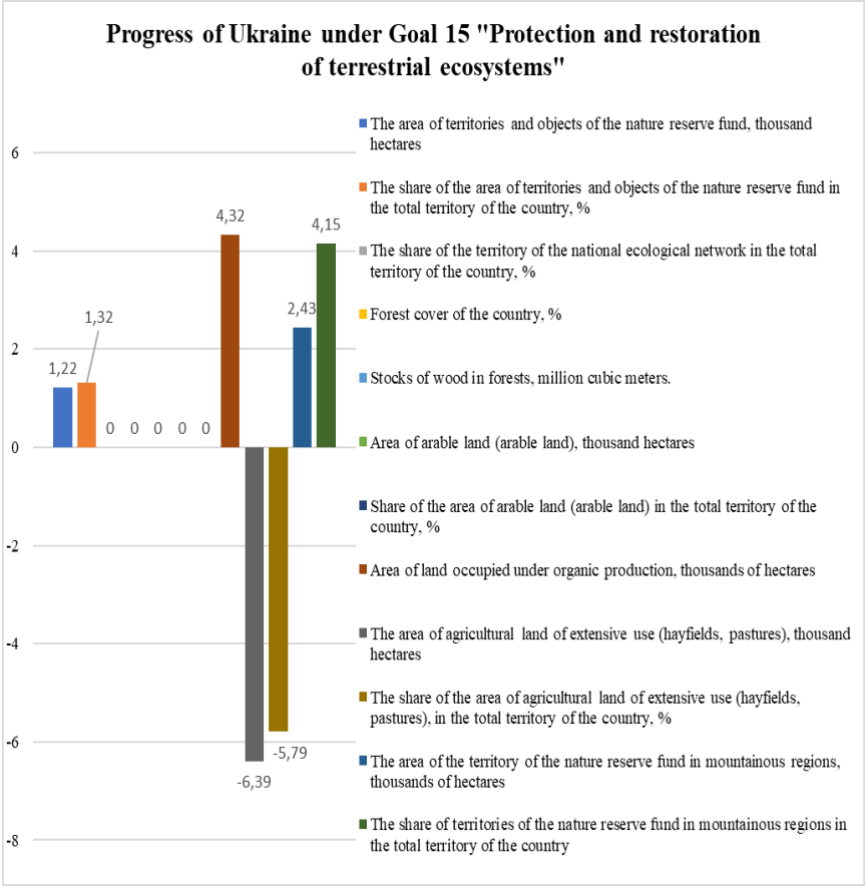

Fig. 15 – Progress of Ukraine under Goal 15
«Protection and restoration of terrestrial ecosystems»

Goal 16: Peace, justice and strong institutions

Ukraine faces challenges to peace and stability, particularly in connection with the military conflict on its territories. One of the key aspects of sustainable development is to ensure peace and security. Peace and justice are necessary prerequisites for achieving other sustainable development goals. Building just and inclusive societies based on human rights, the rule of law, good governance and effective institutions is an essential task for peace and security. Ukraine faces complex challenges in this context, such as achieving peace in its territories, rebuilding infrastructure damaged by the military conflict, and preventing possible new conflicts (fig.16).

Fig. 16 – Progress of Ukraine according to indicators Goal 16 «Peace, justice and strong institutions»

Goal 17: Partnership to achieve goals

Cooperation with other countries and international organizations is important for achieving all the goals of sustainable development. Ukraine should actively interact with international partners and attract support to implement its obligations, however, the conflict in Ukraine represents a serious threat to global sustainable development. This crisis has become the biggest humanitarian disaster in Europe in recent decades. It is predicted that the global economic instability will lead to a reduction in the financing of the countries of the world and will significantly affect the achievement of the Sustainable Development Goals, in particular the 17th. In addition, the conflict affects international trade systems through the imposition of sanctions and other negative consequences. Macroeconomic stability suffered from these events, as noted by international organizations (fig.17).

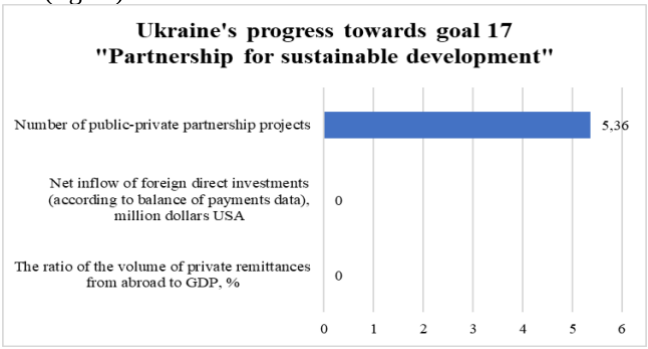

Fig. 17 – Ukraine's progress towards goal 17 «Partnership for sustainable development»

Ukraine has made progress in achieving some of the sustainable development goals adopted by the UN by 2030. In recent years, some improvements have been made in the areas of poverty, education, health and the environment. In particular, Ukraine is actively developing renewable energy sources, taking steps to improve infrastructure and combat climate change. However, there are important challenges that require attention and decisive action. Among them are the fight against poverty and inequality, improving the quality of education, developing health and medical care, as well as ensuring access to clean water and proper sanitation. One of the biggest achievements was the significant reduction in poverty. Data from the 2021 Voluntary National Survey indicate a decline in the poverty rate from 58.3% in 2015 to 43.2% in 2018. However, these positive trends are currently under threat - UNDP forecasts indicate that if the conflict is extended for another year, up to 90% of the population of Ukraine may find themselves in a situation of poverty or vulnerability to it. In addition, Ukraine has to solve complex tasks in the context of the conflict, which affect peace and stability. An important part of achieving the Global Goals is cooperation with international partners and attracting international support. Ukraine should cooperate with the UN and other international organizations, as well as actively work on domestic policy reforms to ensure sustainable improvement in all spheres of life of the population and the environment.

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ANALYSIS OF THE STATE OF PAYMENT SYSTEMS IN UKRAINE IN THE CONTEXT OF THE EUROPEAN VECTOR OF ENERGY EFFICIENCY

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The payment system and infrastructure is a sector that is not given enough attention today in the context of energy efficiency. This sector plays a big role in organizing and ensuring money circulation and funds. It has its value consisting on the one hand of the cost of payment equipment, infrastructure, payment instruments. On other hand, its value consists of the cost of energy for their manufacture and maintenance.

The European Commission has proposed raising the target for reducing greenhouse gas emissions, including emissions and removals, to at least 55% by 2030 compared to 1990.

The EU's ambitions to improve energy efficiency can be enhanced either by improving the energy efficiency of each sector or by improving some sectors more than others. And there are thousands upon thousands of areas in which energy efficiency can and should be improved: from matchmaking to, in fact, payment transactions. The payment system and money circulation seem to be not the biggest problems in the energy sector. However, this is a very delicate topic, because often people pay in supermarkets the money earned, buying food and basic necessities. They spend their energy in vain, waiting in line for a payment transaction.

Modern means of payment and payment methods do not address the problem of reducing the time for servicing payments, which entails the overuse of time, energy, and mon-ey. And the latest method of payment using cryptocurrencies can not change the situation for the better today. The use of new and advanced technologies such as new generation data transmission systems, the use of modern computers' computing power, the replacement of means of payment with "faster" ones, the use of more efficient cashiers, or their replacement by functional machines can reduce these indicators [1].

Ukraine's accession to the European Union and integration into the global economy creates a need to analyze and improve national payment systems. The global payment services industry is irreversibly moving towards "open banking" (Open ARI), as evidenced by the adoption and implementation of the Second Payment Services Directive (PSD2) in the European Union [2].

European Central Bank (ECB) structures its work on European financial integration around three main elements.

First, the ECB has adopted a definition of financial integration: it considers the market for a given set of financial instruments or services to be fully integrated when all potential market participants in such a market are subject to a single set of rules when they decide to deal with those financial instruments or services, have equal access to this set of financial instruments or services, and are treated equally when they operate in the market.

Second, building on this definition, the ECB has sought to devise a way to capture, in quantitative terms, the state of financial integration in the euro area. Quantitative indicators of financial integration in the euro area provide the basis for a comprehensive assessment of both the current level of financial integration and its evolution over time. Analysis of the state of European financial integration and the monitoring of its progress over time are prerequisites for targeted action designed to foster financial integration. Moreover, in view of the envisaged extension of the report's scope, ECB staff are working on additional quantitative indicators, capturing for example measures of financial development.

Third, the Eurosystem contributes to furthering the financial integration process in four main ways:

– giving advice on the legislative and regulatory framework for the financial system and on direct rule-making;

– acting as a catalyst for private sector activities by facilitating collective action;

– enhancing knowledge, raising awareness and monitoring the state of European financial integration;

– providing central bank services that also foster European financial integration.

So, on the one hand, European integration requires Ukraine to comply with the standards and requirements of the European Union in the operation of payment systems. This implies the introduction of new technologies, standards, and rules in the field of cashless payments, personal data protection, and cybersecurity.

On the other hand, the conditions of European integration are an incentive for further development of payment systems in Ukraine. This process may include the creation of new payment services and products that meet the requirements of European standards and the needs of users in terms of security, reliability, and efficiency. The conditions of European integration can also stimulate cooperation between Ukrainian and European payment systems, which will allow for a more efficient exchange of payment transactions between countries. Modernization of payment systems to meet the best international standards, taking into account European integration and globalization, especially in the context of energy efficiency, is extremely important for Ukraine today.

The growth of international trade and globalization processes is the main prerequisite for improving payment systems, which must be ready to make international payments and perform international financial transactions. Modifications to payment systems are also driven by changes in financial services regulations and legislation; growth in the number of electronic payment services and reduction in cash turnover; increase in the volume of payment transactions while improving the efficiency and speed of processing transactions; and introduction of new technologies, such as blockchain and artificial intelligence, which can improve the security and efficiency of payment systems.

Currently, the general principles of payment system operation in Ukraine are regulated by a number of legal acts. In particular, to integrate the Ukrainian payment market with the European one, the Law of Ukraine "On Payment Services" was enacted [3] and the National Bank of Ukraine adopted a number of regulations, including: "On the Procedure for Issuing and Acquiring Payment Instruments", "On the Procedure for Oversight of Payment Infrastructure in Ukraine" and "On the Procedure for Disclosure of Information by Non-Bank Payment Service Providers". Modern legal norms bring Ukrainian legislation closer to EU legislation, promote competition, expand the capabilities of existing payment market participants and create conditions for the emergence of new ones.

According to the Payment Infrastructure Register [4], payment systems in Ukraine can be classified according to various criteria:

– depending on the type of owner, payment systems can be created by: the central bank; banks; non-bank financial and credit institutions;

– depending on the form of ownership: private, state (national);

– depending on the territory of the payment system and the location of its payment organization: domestic, international;

– depending on the residency of participants: with participation of only residents; with participation of residents and non-residents;

– depending on the average payment amount and service segment: retail payment systems (money transfer systems, card payment systems); wholesale payment systems.

In addition, the NBU, in accordance with international practice, divides payment systems into categories of importance (Table 1), with the criteria being the volume of transactions and types of services provided by these systems [4].

As of 01.01.2023, 54 payment systems were registered in Ukraine, including: two state payment systems (the System of Electronic Payments of the National Bank of Ukraine (SEP) and the National Payment System "Ukrainian Payment Space" (NPS "Prostir"); 36 established by residents (15 by banks, 21 by non-bank institutions); 16 established by non-residents. In addition, as of the beginning of 2023, the following participants were registered in Ukraine: 132 payment system participants (except for EPS) and 35 payment service providers.

Table 1 – Distribution of payment systems in Ukraine by importance criteria in 2022

Categories of importance	Criteria for determining the importance	Payment systems
Systemically important	> 10% of interbank transfers in the country; execution of transactions with government securities on the open market; ensuring settlement of obligations of participants arising in other payment systems	System of Electronic Payments of the National Bank of Ukraine - SEP
Important	> 10% of payment transactions; > 10% of payment transactions with the use of electronic means of payment issued in this payment system; the only one by type of service	MasterCard, Visa, NovaPay, Financial World, Postal transfer

An analysis of payment systems over the past four years shows that the largest volume of payments within Ukraine is made through the NBU's SEP (UAH 107,0 trillion, or 95,7% of the total amount of transactions in payment systems for 9 months of 2022). The dynamics of SEP utilization in 2018-2022 is illustrated in fig. 1, which shows an increase in the volume of payments and a significant decrease in their number [4].

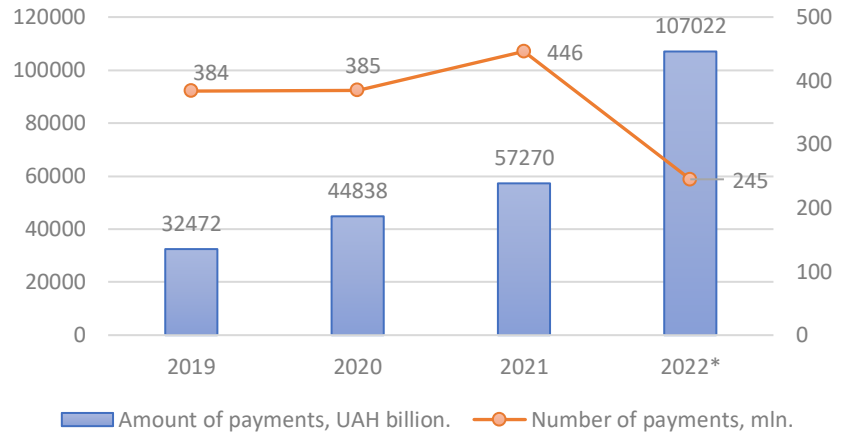

Fig. 1 – Dynamics of SEP utilization in 2019-2022

Notes*. The period of May - December 2022 was taken for analysis due to the suspension of statistical reporting on transactions with payment cards for February - April 2022 in accordance with the current Rules for Organizing Statistical Reporting

In 2022, despite the full-scale war and missile attacks, the NBU's electronic payment system reliably and uninterruptedly performed its functions and fully met the needs of the Ukrainian banking system and its customers for settlements in the national currency. The resilience of the SEP was maintained through the effective measures designed to ensure the NBU's continuous operation, including the NBU's payment systems, in particular:

1) a business continuity management system has been established, within which the NBU organizes and plans, in particular, the continuity of the NBU's payment systems;

2) a disaster recovery plan has been created that is constantly being improved to take into account existing and emerging risks;

3) geographically distributed processing and backup centers and related infrastructure have been set up, and training sessions on deploying operations at backup locations have been conducted;

4) the composition of the evacuation (mobilization) team in case of a special period, etc. [5].

However, martial law and a sharp decline in economic activity in the first months of the war affected the number of transactions in the system, which decreased by 18,7% last year compared to 2021. According to the structure of SEP payments in the 2022, it should be noted that

- small payments were processed most often by number, namely: 51% of payments were from UAH 1 thousand to UAH 100 thousand, 45% - up to UAH 1 thousand, and 4% - from UAH 100 thousand and more;

- large payments accounted for the largest share of payments by amount. In particular, almost 98% were payments of UAH 100 thousand and more, 2% and 1% were payments of UAH 1 thousand to UAH 100 thousand and up to UAH 1 thousand, respectively.

In terms of the number of payments made, SEP accounts for the smallest share compared to money transfer systems and card payment systems. Thus, card payment systems are in first place in terms of the number of transactions in Ukraine, despite the decrease in transactions to 5,6 billion at the end of 2022 from 7,82 billion at the beginning of the year. Accordingly, the amount of transactions carried out in card payment systems in 2022 decreased by 35,3% to UAH 5058,2 billion (Fig. 2) [4].

Despite the quarantine and restrictive measures introduced in April 2020, which slowed down the development of the payment card market, the volume of transactions using payment cards continued to grow in 2020 and 2021. Almost all payment card transactions (about 99,9% by number and 99,6% by amount) in 2020-2021 were carried out in international systems, with the remaining volume of transactions accounted for by the NPS Prostir. In 2022, non-cash payments using payment cards decreased: the number of such payments decreased by 26,2% to 5194,4 million (86,9% of the total), while the amount of non-cash payments

increased by 11,1% to UAH 3443,9 billion (55,8% of the total amount of card transactions) (Fig. 3).

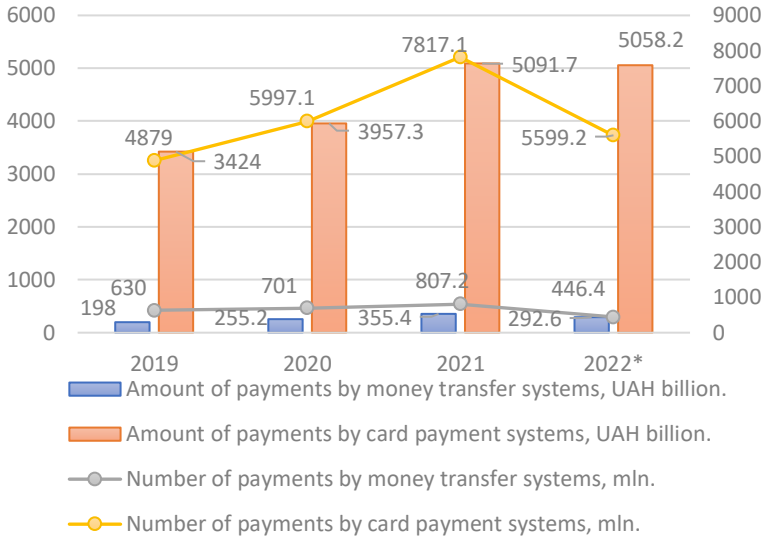

Fig. 2 – Dynamics of payments and their number made through money transfer systems and card payment systems in 2019-2022

Notes*. The period of May - December 2022 was taken for analysis due to the suspension of statistical reporting on transactions with payment cards for February - April 2022 in accordance with the current Rules for Organizing Statistical Reporting

It is important to continuously increase the share of non-cash transactions compared to cash receipts, which is in line with the NBU's strategic goals to reduce the share of cash in circulation. In 2022, the number of non-cash transactions with payment cards in Ukraine and abroad increased by 4.1% to 5,194.4 million (92,8% of the total number of transactions with payment cards), and the amount increased by 56,9% to UAH 3,443.9 billion (68.1% of the total amount of transactions with payment cards) compared to the same period in 2021. This demonstrates that the payment infrastructure, despite the active hostilities in Ukraine, ensures reliable servicing of non-cash payment card transactions and a high level of trust of Ukrainians in non-cash payments even in times of war thanks to the dedicated work of financial market participants.

In recent years, the volume of transactions and money transfer systems created by both residents and non-residents has been actively increasing (Figure 4).

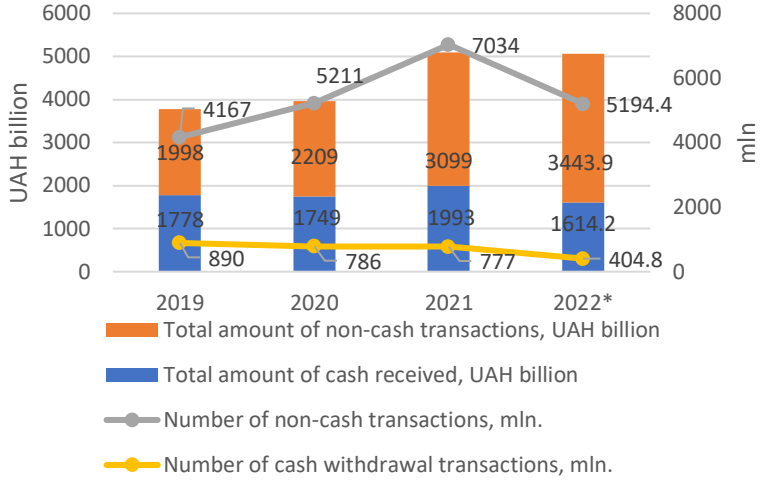

Fig. 3 – Dynamics of transactions made with payment cards in 2019-2022

Notes*. The period of May - December 2022 was taken for analysis due to the suspension of statistical reporting on transactions with payment cards for February - April 2022 in accordance with the current Rules for Organizing Statistical Reporting

It is worth noting that the Resolution of the Board of the National Bank of Ukraine No. 18 "On the Operation of the Banking System during the Period of Martial Law" dated February 24, 2022 prohibits transfers from Ukraine to foreign countries during the period of martial law.

At the same time, cross-border transfers were made mainly using systems created by non-residents, while the vast majority of transfers in systems created by residents were made through systems created by non-bank financial institutions. Ukraine remains a recipient country of cross-border remittances with a tendency to a significant decrease in the ratio of remittances received in Ukraine to those sent outside the country.

Despite the dynamic development of payment systems in Ukraine in the context of the coronavirus crisis and active hostilities, there are a number of systemic problems. Thus, among them are the following [6]:

– monopolization of the market by international payment systems;

– low level of electronization of payments compared to other countries, with a high share of cash in payments;

– high fees for using payment systems, which makes electronic payments less attractive to users;

– insufficient regulatory framework for payment systems, which may lead to unclear and ambiguous situations in this area;

– vulnerability of payment systems to various types of abuse and fraud, which can lead to large financial losses for customers and payment systems;

– low level of financial inclusion and financial literacy of customers;

– lack of a unified payment system, which may create interoperability problems and impede rapid market development;

– increased transaction energy costs for payment processing.

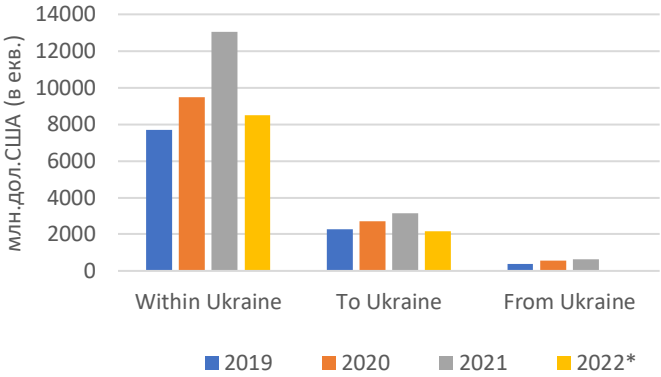

Fig. 4 – Amount of transfers made through money transfer systems in 2019-2022

Notes*. The period of May - December 2022 was taken for analysis due to the suspension of statistical reporting on transactions with payment cards for February - April 2022 in accordance with the current Rules for Organizing Statistical Reporting

The problem of energy efficiency in payment systems lies in the significant energy consumption associated with processing and storing data and transactions. The efficiency of a payment system refers to how well it optimizes resources and minimizes the costs and risks of transactions. To evaluate payment systems for quality and efficiency, you should consider factors such as speed, cost, scalability, and sustainability. Speed measures the time it takes from initiation to confirmation and delivery of funds. Cost looks at fees or charges imposed by the payment system. Scalability evaluates its ability to handle a large volume and variety of transactions. Sustainability looks at its environmental and social impact, as well as its contribution to reducing waste, energy consumption, and carbon footprint. A few aspects that impact the energy efficiency of payment systems:

1. Data centers: payment systems require powerful data centers to store large amounts of data. These data centers require substantial amounts of electricity to operate, including the cooling of servers.

2. Transaction operations: Processing transactions involves computations and data transmission over networks, which also require energy, especially when dealing with a large number of transactions, as in large payment systems.

3. Security: ensuring the security of payment transactions involves complex cryptographic operations that may require significant computational resources, leading to increased energy consumption.

4. Security standards: payment systems must adhere to strict security standards, which can result in higher energy consumption due to additional security measures that need to be implemented.

5. Growing popularity of payment systems: as the popularity of payment systems grows, so does the load on their infrastructures, which leads to increased energy consumption.

Such conclusions about energy efficiency stem from a detailed look at the new technologies that are shaking up how global consumers make purchases and send money. Digital currencies often rely on distributed ledgers for validating and recording transactions. In those cases, how much energy they use mainly depends on two factors.

The first is how network participants agree on transaction histories. Some crypto assets like Bitcoin use a proof-of-work consensus mechanism that needs substantial calculation power, and energy, to obtain the right to update the transaction trail. Other crypto types use different approaches for their ledger updates that don't require as much computing muscle.

The second is access to distributed-ledger systems. Some of these are permissionless, allowing anyone to join and validate transactions. Entry to others requires permission from a central authority, which offers greater control over key aspects of energy consumption such as the number of network participants, their geographic location, and software updates.

The research shows that proof-of-work crypto uses vastly more energy than credit cards. The card payment leader Visa has 4 data centers located in Central US, East US, UK, and Singapore, with a private communication network of 10 million route miles (400 times earth circle). Although Visa 23 keeps confidential the exact energy required by its datacenters, it is possible to compute that Visa's they require on average 305 MW per data center to operate [7]. These calculations are based on Visa's annual report stating that Visa's datacenter energy consumption stayed stable between 2017 and 2020 totalling 446 million kWh. This estimation leads to an energy consumption by Visa ≈ of 2,7 TWh/yr. Visa's market share can be estimated to be about 15% of total cards in the world. This can be obtained through Visa's declaration that is processes 3.8 Billion cards and we know that the total number of payment cards was 25.2 Billion cards in 2021. Now we can see that the total card schemes payments datacenter consumption is ≈ 17,72 TWh/ yr to operate all card payments worldwide.

According to the University of Cambridge [8], cryptocurrency mining consumes approximately 127,24 TWh/yr. This is more than in such countries as: Argentina – 125,03 TWh/yr; Norway – 124,13 TWh/yr. But less than in: Ukraine – 128,81 TWh/yr; Sweden – 131,8 TWh/yr. According to a report from Deutsche

Bank, the energy consumption per transaction for Bitcoin is high in comparison with other means of payment, for instance card payments. An individual Bitcoin transaction generates the same carbon dioxide emission as one person's aircraft journey across Europe. On the other hand, transactions using the crypto currency Ripple have a very low energy consumption, which shows that the high energy consumption for Bitcoin does not necessarily apply to all crypto currencies. The report also shows that energy consumption for card payments is lower than for cash.

Table 2 – Bitcoin requires a lot of energy in relation to card payments

Payment methods	KWh per transaction
Ripple	0,00001133
Visa (USD)	0,00649
MasterCard (USD)	0,00649
Cash (printed euro banknote)	0,08
Ethereum	20,294
Bitcoin	118

But there's more to payment systems than processing technologies. Total energy use varies by technology, payment-chain size, and other additional features.

Considerations like these resonate with central banks considering digital currencies [9]. Many central bank digital currencies projects build on energy efficient distributed-ledger systems under which only permissioned institutions like commercial banks can join and validate without proof-of-work.

Other options that don't feature distributed ledgers are also being considered, and some of these are seen as promising from an energy-consumption standpoint. That means central bank digital currencies have the potential to reduce the power needs for digital payments, and even be more energy efficient than the credit card networks now widely used.

Central bank digital currencies are still in their early days, and it's hard to know how far and how fast they might go, but it is clear that central banks will adopt new technologies that impact power use. Their energy-saving potential will depend on the use associated with other design features that may be added for compliance, to aid security and integrity, or to facilitate universal access.

For example, some central banks are considering whether central bank digital currencies should be accessible through physical cards, like credit cards. Card payments use more energy than those with digital wallets, which is how most crypto transactions are made. But cards can help adoption and inclusion, particularly when digital literacy or mobile network connectivity are a concern.

As payment systems increasingly use distributed ledgers, there's a clear case for those more energy-efficient options that are permissioned and don't rely

on proof-of-work mechanisms. And though the debate on the future of money is still in its early stages too, power use is just one among many considerations.

The prospects for the development of the payment systems market in Ukraine are associated not only with further technological development of the payment infrastructure, improving the quality and efficiency of payment services, strengthening the protection of the interests of payment system participants and consumers, and increasing the financial literacy of the latter, but also, above all, with improving the regulatory framework for the functioning of this market in the context of European integration. In this regard, it was extremely important to adopt in mid-2021 the long-awaited Law of Ukraine "On Payment Services" [3], which took into account the provisions of the European Directive PSD2 to strengthen competition, protect the rights of payment service users and introduce new technologies.

PSD2 (Payment Service Directive 2) is the second EU Directive on payment services (2015/2366), the main purpose of which is to develop the electronic payment market and create favorable conditions for making secure payments and which offers wider payment options [2].

Whereas today in Ukraine only one type of payment service is regulated by law - the financial service of transferring funds - the new law introduces nine payment services, seven of which are financial (including services for issuing electronic money and conducting payment transactions with it, opening and maintaining electronic wallets) and two are non-financial (services for initiating a payment transaction and services for providing information on accounts).

The Law defines nine categories of payment service providers, which include: banks; payment institutions (including small payment institutions); branches of foreign payment institutions; electronic money institutions; financial institutions authorized to provide payment services; postal operators; non-financial payment service providers; the National Bank of Ukraine; state authorities and local self-government bodies.

Non-bank financial institutions will not be required to participate in payment systems for making transfers, which will simplify their operations and reduce the cost of their registration. Banks will be allowed to provide all financial services, while other providers will be allowed to provide only those services for which they are licensed. They have the right to provide the relevant services after being included in the Payment Infrastructure Register.

The Law creates the conditions for the introduction of open banking in Ukraine, which means that payment service providers are obliged to provide banks and other payment service providers with real-time access to their customers' accounts. It is worth noting that the NBU has already started cooperation with Ukrainian payment market participants to develop unified standards for open APIs (Application Programming Interface) and plans to launch open banking in Ukraine in 2023. The new generation of the NBU's interbank electronic payment system,

SEP 4.0, based on the international standard ISO 20022 and operating around the clock (24/7), will increase the country's competitiveness and facilitate the integration of Ukraine's payment market with the global one.

The law provides that not only the NBU and banks may act as issuers of electronic money in Ukraine, but also: electronic money institutions; branches of foreign payment institutions; postal operators; state authorities and local governments. The NBU is authorized to issue digital money, an electronic form of the Ukrainian currency. The NBU is to develop rules for the circulation of digital hryvnia, as well as the procedure for its issuance, storage, and redemption. In addition, the NBU is authorized to create a regulatory platform for testing services, technologies, and instruments in the payment market based on innovative technologies.

Serious attention is also paid to protecting the rights of consumers of payment services, in particular, the requirements for information security, protection against cyber threats are standardized, and liability for illegal actions with payment instruments and means of accessing accounts is increasing. Payment service providers are subject to stricter requirements for providing consumers with information (on the amount of fees, additional payments, fines, and terms of service) and fulfilling their obligations to them. The NBU plans to improve methods of remote customer identification and verification, which will allow financial institutions to support the use of products both in Ukraine and abroad.

The introduction and development of alternative types of payments is an important part of the further development of payment systems. Such solutions are offered to expand non-cash payments and alternative transaction channels (mobile networks, cryptocurrencies, P2P platforms, M2M payments, cloud payments, etc.). Particular attention should be paid to the digital alternative to cash - virtual assets, in particular, cryptocurrencies and the blockchain technologies on which they are based.

A blockchain can be thought of as a distributed public ledger where groups of transactions or events are recorded and stored in a sequential, chain-like data structure. Such groups of transactions are called blocks and are organized in a chain by the time of the transaction. Further blocks, the number of which is unlimited, are added to the end of the chain, storing the hash of the previous block. A block can contain any information: about actions, people, objects, transactions, serial numbers, loans issued, etc. In this system, each participant has an identical copy of the ledger. If any particular node in the system is malfunctioning, the information will not be lost irretrievably, but will be preserved in full and complete, since every other participant has a copy of the exact same database. In addition, the transaction log is saved, not just the final results (for example, data on current balances), which protects the system from manipulation or falsification of data. The digital signature of the parties to the transaction certifies the validity of the transactions. Signed transactions are sorted into separate blocks, and each block

in this chain is assigned a unique, so-called "hash code" generated by computers using a complex mathematical formula. Making changes to transaction data will change the hash code of the block where it is stored. It is important that these changes are reflected simultaneously in all blocks of the chain. Thus, a possible change will be, firstly, immediately registered, and secondly, immediately identified and tracked by all network participants. As a result, the blockchain has a number of advantages, including authentication of peer-to-peer transactions and an automated, encrypted, real-time register of such transactions.

Along with the positive characteristics of blockchain, there are certain disadvantages of this technology. The widespread use of blockchain technologies faces unresolved technological, legal, regulatory and ethical issues. Technological problems are caused by the specifics of the blockchain. Encryption of records can make it impossible to access the system in case of password loss. The high energy intensity of so-called mining, which ensures the necessary decentralization of the blockchain ecosystem, remains unresolved. The lack of a mechanism for reversing erroneous transactions is still an issue. The advantages and disadvantages of blockchain for banking are summarized in Table 3.

Table 3 - Characteristics of the blockchain in terms of matching advantages and disadvantages

Advantages	Disadvantages
Reliability Efficiency	Energy consumption; Lack of standards; Novelty for the client; Complication of financial monitoring
Security; Transparency	Energy dependence; Lack of standards; New cyber vulnerabilities; Complication of financial monitoring
Confidentiality; Decentralization; Lack of standards	Energy dependence; Transparency
Controllability; Compromise	Energy dependence; Decentralization; New cyber vulnerabilities; Complications of financial monitoring

Modern means of payment and payment methods do not solve the problem of reducing the time required to service payments, which entails time, energy, and money overruns. And the newest payment method using cryptocurrencies cannot change the situation for the better today.

Table 3 – Terminal maintenance costs for completing a transaction using a cryptocurrency based on blockchain technology [10]

Maximum	Minimum	The average	
86 691 000 000	86 691 000 000	86 691 000 000	operations
142380	600	2487,6	second for the operation
12 343 064 580 000 000	52 014 600 000 000	215 652 531 600 000	seconds
205 717 743 000 000	866 910 000 000	3 594 208 860 000	minutes
3 428 629 050 000	14 448 500 000	59 903 481 000	hours
342 862 905 000 000	1 444 850 000 000	5 990 348 100 000	Wh
342 862 905 000	1 444 850 000	5 990 348 100	Kwh
342 862 905	1 444 850	5 990 348	MWh
208,34	208,34	208,34	EUR/MWatt
71 432 057 628	301 020 049	1 248 029 123	EUR
29 480 903	124 235	515 077	tonne of oil equivaient (toe)

The use of the latest and most promising technologies, such as new-generation data transmission systems, the use of computing power of new-generation computers, the replacement of payment methods with faster ones, the use of more efficient cashiers or their replacement with functional machines, can help reduce these indicators.

Our research demonstrates the problem that too much time is spent on servicing payments made with currently available payment methods and means of payment. This results in time, energy, and cost overruns due to imperfect payment infrastructure and payment instruments.

Reducing the transaction energy costs of servicing payments by at least a third through investments in high-speed data transmission technologies, infrastructure, changes in the way customers and cashiers think and behave, etc. would reduce overall energy consumption worldwide. Such a step would not by itself contribute to solving an important social problem - reducing greenhouse gas emissions.

The study on the state and development directions of payment systems in Ukraine allows us to draw the following conclusions. The assessment of the state of Ukraine's payment systems, taking into account their structure and key participants, showed that by 2022 the amount and number of payments made through various money transfer systems will increase, especially within Ukraine.

The largest number of payments was made through card payment systems, and the largest volume of payments was made through the NBU's SEP.

Ukraine's payment system is undergoing active development and modernization and has the potential to develop and improve in the future. It is expected that the new rules for the functioning of payment systems and the implementation of the provisions on European integration will give a positive impetus to the development of innovative business solutions in the payment services market, which will increase competition for customers and ensure equal cooperation between Ukrainian financial institutions and European ones, and, as a result, improve the quality of services, their energy efficiency and the level of user protection.

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CONCLUSIONS

In the monograph "Ecological, economic and financial transformation of Ukraine in cooperation with the EU: challenges and prospects," various aspects of Eurointegration environmental components related to air protection in Ukraine, waste management systems, increasing financial literacy of the population, the implementation of EU sustainable development goals in the Ukrainian economy, and the state of payment systems in the context of the European vector of energy efficiency are discussed.

The work provides a detailed examination of the issues related to air protection in Ukraine and Eurointegration efforts in this direction. It offers recommendations for improving the regulation of emissions of pollutants into the air, the development of environmental infrastructure, and the promotion of sustainable use of natural resources.

A comparative analysis of the waste management system in Ukraine and the European Union has allowed identifying key aspects of efficient resource utilization and waste regulation, along with providing recommendations for enhancing the waste management system in Ukraine.

European Experience in Increasing Financial Literacy of the Population: It has demonstrated the significance of financial literacy for the population. It points to possible ways to enhance the financial literacy of the Ukrainian population and improve the effectiveness of personal financial management.

The prospects of implementing the sustainable development goals of the European Union in the Ukrainian economy have revealed both opportunities and challenges in this process. It underscores the urgent need to align the national strategy with European sustainable development standards.

An analysis of the state of payment systems in Ukraine in the context of the European vector of energy efficiency has identified several crucial findings and issues that require attention and immediate action.

The development of innovative payment solutions and mobile payment systems can play a pivotal role in promoting energy efficiency. Quick and convenient access to information about energy consumption and the ability to manage it can help reduce energy resource expenditures.

Therefore, for the successful implementation of energy-efficient measures in Ukraine, it is necessary to pay due attention to the development and modernization of payment systems while creating incentives for consumers and businesses that adopt energy-efficient solutions.

Ecological, economic and financial transformation of Ukraine in cooperation with the EU: challenges and prospects

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