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Problems of financing the state budget deficit

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Abstract. In the context of Russia's full-scale invasion, the agricultural sector remains one of the main sources of budget financing in Ukraine, and therefore requires a more detailed study in this context in the context of war. Thus, the purpose of the study was to assess the current possibilities of financing the Ukrainian budget, with a focus on the role of the agricultural sector in its revenue and expenditure parts. The main research methods used were analysis, forecasting, abstraction, historical, statistical and graphical methods. The study analysed the dynamics of the Ukrainian budget and described the general negative trend observed over time. The study analysed possible areas of raising funds for financing, in particular through bonds, both domestic and foreign, and concluded that such methods are undesirable. The paper also shows that the agricultural sector in Ukraine has become a significant source of replenishment of the country's budget during the war. The information being in the available sources indicates that the share of revenues received from the agricultural sector in the budget of Ukraine is quite high, and the sector itself is in surplus (revenues exceed expenditures). Given the benefits for the budget from the development of the agricultural sector, it is important to support it with both financial and non-financial methods. The results of the work can be used

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by government officials in their management activities within the country or regions, as well as by business leaders in building long-term development strategies

Keywords: economic and mathematical models; water transport; economy of Ukraine; management; macroeconomics

Introduction

The state budget as a whole is a fundamental tool for the functioning of any country and plays an important role in social and economic life (Hashemizadeh *et al.*, 2021). It determines how financial resources are collected and allocated to meet the needs of society and achieve government goals. The state budget also makes it possible to change financial flows in the country and direct them to other areas, which ensures the functioning of the state apparatus and allows the population (especially the poor) to have a decent standard of living (Sadik-Zada & Gatto, 2019). In addition, this instrument can also be a source of economic development, as it, as noted above, determines investments in infrastructure, research and development, which helps to stimulate economic growth and create jobs. Its role is especially important in times of crisis, as government officials, by investing in various sectors of the economy, stop its stagnation and “revive” it (by releasing funds into the economy through increased spending).

A significant number of scholars have been working on assessing the problems that have arisen in Ukraine in connection with the recent crises, and in particular the full-scale invasion of Russia. Thus, H. Shumska (2023) developed methods to ensure effective socio-economic development of Ukraine. She conducted a telephone survey of government officials and, based on this data, drew conclusions about how to improve the efficiency of public administration systems in the country. The prospects and benchmarks for the country's development in the period from 2023 to 2024 were assessed in D. Vasylykivskyi *et al.* (2023). The authors described the main directions of the country's development and pointed out the existing potential for its development, given the war and all the difficulties it brings to its development. Nevertheless, the scientists' assessments do not describe clear scenarios for future developments, and therefore do not allow for the formulation of high-quality recommendations for government officials. Yu. Verheliuk (2022), in turn, studied the possibilities of financing the country's budget, in particular, through market sources. The scientist noted both the advantages and dangers that may arise in the case of financing the state budget with the help of such instruments, and noted their already significant role in terms of the debt structure. M. Hantsiak (2022) conducted a similar study on the possibilities of raising funds to finance the budget deficit from the securities market. The researcher assessed the state of the domestic debt securities market in Ukraine and described the negative and positive components of such a debt policy by the state. However, he did not provide clear alternatives that could replace such methods of financing. I. Chugunov *et al.* (2022) assessed the revenues of the State Budget

of Ukraine under martial law. The authors described the main priorities in the formation of the country's budget and its revenues, and provided some recommendations on how to optimize their receipt and further distribution. However, little attention was paid to the expenditure component of the budget, which is no less important in budget management. Yu. Dziurakh (2019), in turn, analysed the state regulation of investment in agriculture based on international experience. The scientist described a surge in regulatory measures in developed countries aimed at supporting investment in technology, genetic engineering and agriculture. He also described the processes and importance of market liberalization to improve the efficiency of its functioning. V. Dmytriiieva & Y. Sviatets (2021) discussed the use of data cleaning methods to improve the analysis of time series data and used them to study agriculture in Ukraine. Thus, the scientists identified two periods (from 1996 to 2008 and from 2009 to 2018), which were initially defined by decline and stagnation, and later by growth. However, the researchers did not provide advice either to representatives of the public sector or to entrepreneurs to improve their performance. The peculiarities of budgetary financing of agriculture in the country were assessed by K. Zakhzhay & I. Kravchenko (2019). They describe the role of state support for this sector and talk about the insufficient amount of it at present. It is worth noting that in times of war, this information is also relevant, given that local enterprises need support to be able to continue their operations. However, the state is also unable to provide it in such circumstances. L. Sulimenko, & S. Viter, (2019) also studied support for the agricultural sector from the state budget and showed that the level of such support decreased from 3.7% to 0.22% in 2004 and 2020, respectively. This may indicate either that the sector is in a relatively better position compared to previous years, when it does not need support, or that the state cannot provide it, given the problems in the country. Thus, this indicates the state of development of the industry and its interaction with the budget. The purpose of this study was to assess the existing problems associated with the state budget deficit in Ukraine and to propose methods of financing it in the short and long term. This will help to improve the efficiency of public policy in the country as a whole, in particular in the context of the agricultural sector.

Materials and Methods

The study used some data that characterize the state budget of Ukraine from different angles. Statistical information for their assessment was used from various freely available Internet resources. For instance, information was used

from the MinFin website (State debt of Ukraine, 2023), which contains information on the level of public debt in the country, its dynamics and changes in comparison with the gross domestic product (GDP). The information provided by the Ministry of Finance of Ukraine (Statistical collection, 2022) was also used, which describes in detail the state of the country's budget. Information on state budget revenues and expenditures from the agricultural sector was obtained from the website "Price of the State" (Expenditure by function, n.d.), and data from the State Statistics Service of Ukraine was used to assess the state of agricultural enterprises in Ukraine.

Some indicators were also used to assess the state of the Ukrainian budget. In particular, the indicators of budget expenditures and revenues, as well as the budget deficit, were analysed. Its value was determined using the formula below:

$$D = I - E, \tag{1}$$

where D – budget deficit; I – budget revenues; E – budget expenditures.

In addition, the percentage of the deficit to the total budget of the country was estimated. In general, this can be done either as a percentage of expenditures or revenues. However, in the case of Ukraine, the results could vary greatly depending on which value is used in the denominator. Thus, a compromise was chosen, whereby the relative budget deficit is averaged. The formula for its calculation is given below:

$$D_{\%} = \frac{D}{\left(\frac{I+E}{2}\right)} = \frac{2D}{(I+E)}. \tag{2}$$

As can be seen from the formula above, the denominator uses the average of budget expenditures and revenues, which averages the relative value of the budget deficit. This

allowed for a better assessment of the value of the budget deficit in Ukraine in the period from 1992 to 2022. All data was evaluated, and graphical elements were created using Microsoft Excel. The approach used in this study was a systematic one. It allowed representing the factors that affect the possibilities of financing the budget deficit in Ukraine in the form of separate, interconnected parts that interact with each other within a single system. In turn, one of the main methods used in the study was analysis. It allowed assessing various indicators of the state budget and the state of development of the agricultural sector in Ukraine based on the available quantitative and qualitative information about them found in various open sources. In addition, the historical method was used to assess the impact of various historical events on the current state of the state budget and the agricultural sector. It also made it possible to conduct research on individual indicators based on past data, in retrospect, and to see their impact on the current state of the country's economy. Abstraction was also used, which made it possible to assess phenomena without including the influence of individual factors that had a minor impact on the change in a given phenomenon. Forecasting was used to formulate assumptions about future changes in the structure and size of the state budget of Ukraine, the role of the agricultural sector in it, and methods of its financing. The statistical method was used to evaluate quantitative data. The construction of graphs and tables in the paper was carried out using the graphical method.

Results

Before assessing the problems of financing the state budget deficit in Ukraine, it is worth reviewing some of the main metrics that characterize it. One of them is the public debt, the dynamics of which and its ratio to GDP are shown in Figure 1 below:

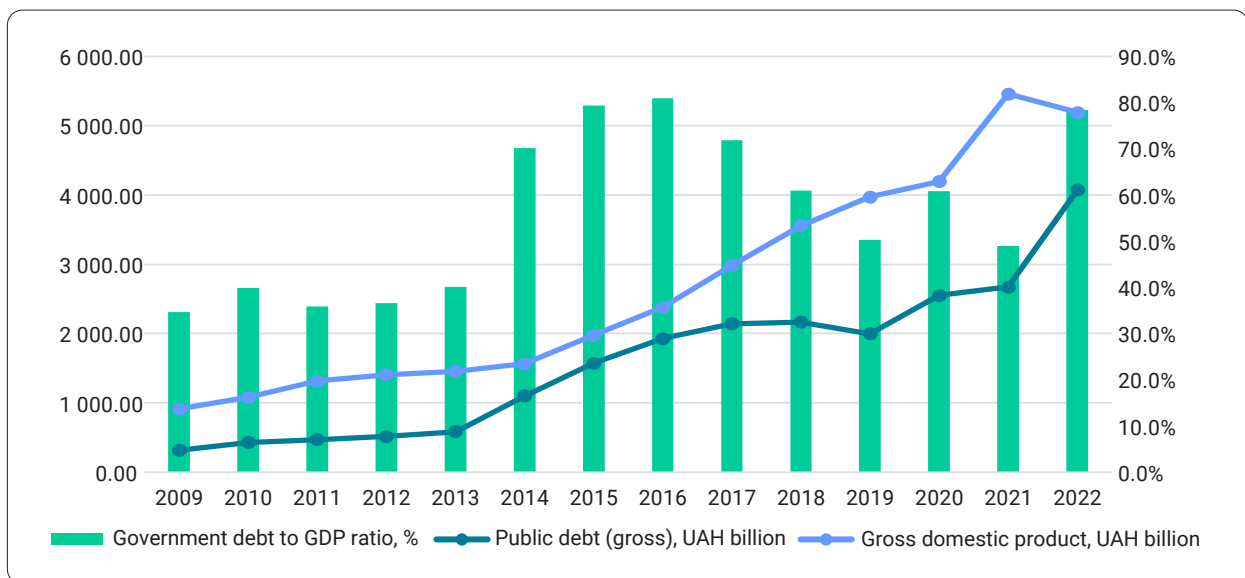


Figure 1. Indicators characterizing the level of public debt and gross domestic product in the period from 2009 to 2022
Source: compiled by the author based on the data from State debt of Ukraine (2023)

As shown in Figure 1, public debt, like GDP, has been gradually increasing, which is normal for any country. The public debt indicator in Ukraine has varied quite a bit over the years and could reach both higher and lower values depending on the period. For example, before 2014, the level did not exceed 40%, while after the outbreak of the war with Russia, it reached 70% and 80%. After relative stabilization, it rose again to 78.4% as of 2022, which is associated with the full-scale Russian invasion. During the assessment, it was noticed that there is a certain correlation between the selected indicators (GDP and public debt): it was observed that it is negative and is at the level of -0.33. This suggests that when the level of public debt increased, GDP growth decreased and vice versa; and although the correlation is not significant and can generally be explained

by other reasons (the decline in GDP growth was caused by external factors that forced the state to increase its debt to overcome), this influence cannot be dismissed. Thus, the current level of public debt in the country is too high to ensure its welfare, especially given that even if the war ends soon, it is expected to grow further, given the country's need for funds for recovery. Public debt is one of the main public debt financing challenges for the country, but its impact will be particularly noticeable in the long run. For the time being, Ukraine's ability to incur debt allows it to finance essential expenditures and ensure a decent level of economic development and living standards.

At this point, it is worth looking at how Ukraine's overall expenditures, revenues, and budget deficit have changed in recent years. This is shown in Figure 2 and Figure 3 below:

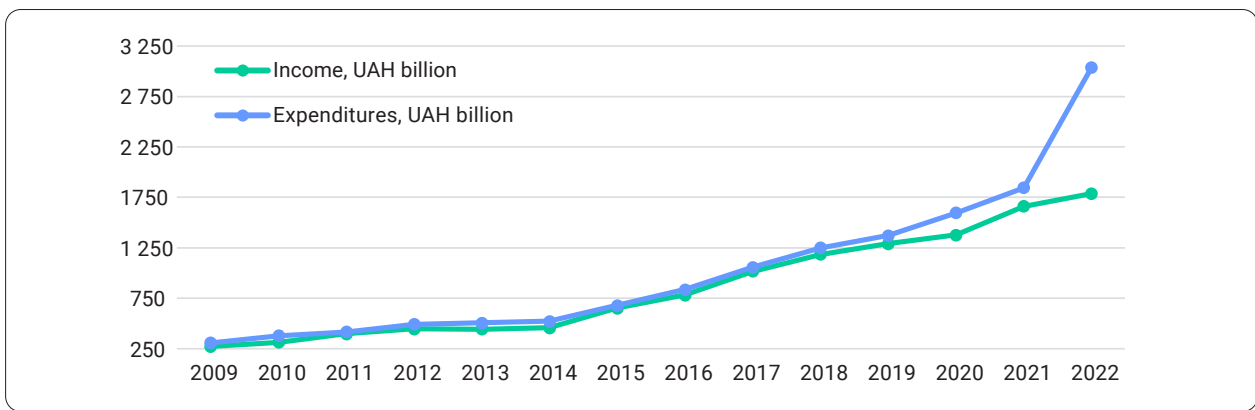


Figure 2. Revenue and expenditure parts of the budget of Ukraine in the period from 2009 to 2022, UAH billion
Source: compiled by the author based on the data from Statistical collection (2022)

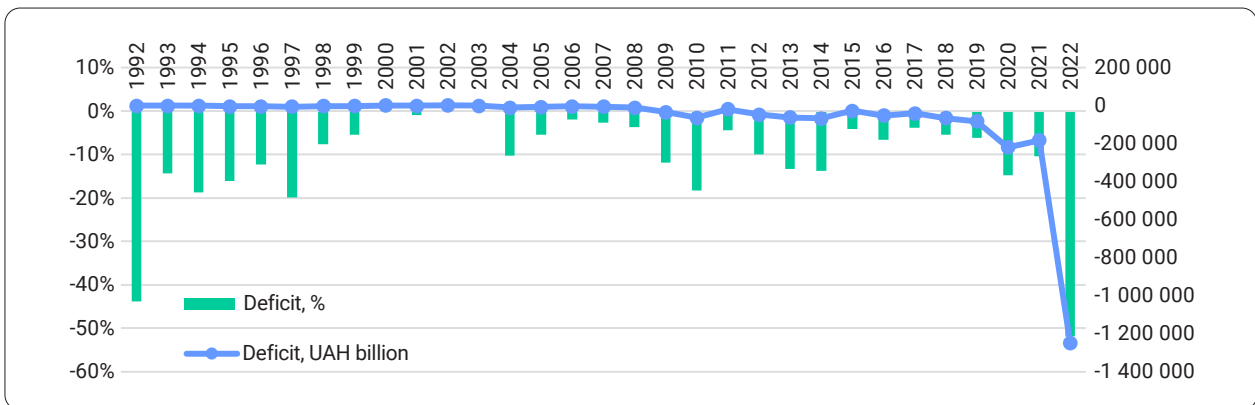


Figure 3. The level of the budget deficit in Ukraine in absolute and relative values in the period from 1992 to 2022
Source: compiled by the author based on the data from Statistical collection (2022)

As can be seen from Figure 2, budget revenues and expenditures in Ukraine have been gradually increasing, primarily due to the depreciation of the hryvnia and the growth of the country's economy. More revealing is Figure 3, which shows the budget deficit in absolute and relative terms. As can be seen, the level of budget deficit in Ukraine could take different values depending on the year: from positive values (surplus) to more than -40% in the early years of the country's formation. Such

data indicate frequent cases of difficulties in financing the Ukrainian budget deficit. The data for 2022 are also indicative, where the level of budget expenditures was cut in half compared to the previous year (due to the beginning of Russia's full-scale invasion), but revenues could not grow by a similar amount due to the lack of ways to obtain them. A more detailed assessment can be made by looking at the structure of expenditures, which is shown in Tables 1 and 2:

Table 1. Absolute indicators of budget revenues in Ukraine in the period from 2017 to 2021, UAH million

Year	2017	2018	2019	2020	2021
Income	1 016 969.50	1 184 290.80	1 289 849.20	1 376 673.80	1 662 333.60
VAT	313 980.60	374 508.20	378 690.20	400 600.10	536 489.10
Personal income tax and levy	185 686.10	229 900.60	275 458.50	295 107.30	349 785.50
Other	218 665.50	225 078.20	265 606.20	269 330.20	235 289.60
Excise tax – total	121 449.40	132 649.80	137 076.40	153 850.30	180 300.40
Corporate income tax	73 396.80	106 182.30	117 316.80	118 471.80	163 844.50
Own revenues of budgetary institutions	52 658.80	65 884.80	63 676.20	82 201.50	107 306.00
Rent and fees for the use of other natural resources	51 132.30	50 086.90	52 024.90	57 112.60	89 318.50

Source: compiled by the author based on the data from Statistical collection (2022)

Table 2. Relative indicators of budget revenues in Ukraine in the period from 2017 to 2021, %

Year	2017	2018	2019	2020	2021
Income	100	100	100	100	100
VAT	30.9	31.6	29.4	29.1	32.3
Personal income tax and levy	18.3	19.4	21.4	21.4	21.0
Other	21.5	19.0	20.6	19.6	14.2
Excise tax – total	11.9	11.2	10.6	11.2	10.8
Corporate income tax	7.2	9.0	9.1	8.6	9.9
Own revenues of budgetary institutions	5.2	5.6	4.9	6.0	6.5
Rent and fees for the use of other natural resources	5.0	4.2	4.0	4.1	5.4

Source: compiled by the author based on the data from Statistical collection (2022)

As can be seen from Tables 1 and 2, the bulk of Ukraine's budget revenues came from value added tax, which was largely distributed to other enterprises. At the same time, personal income tax, excise tax, and corporate income tax play a significant role. However, this breakdown is expected to change in 2022, when tax collection in the country has fallen sharply due to weakening economic activity, while dependence on international aid has increased. The data is not yet available and may not be until the war is over, but it is certain that the foreign aid component plays a significant role. Revenues from the agricultural sector have also played an important role in the Ukrainian budget since 2014. The reason for this is that other important sectors of the country's economy have experienced significant difficulties, both after the outbreak of the war in Ukraine (in 2014) and during the full-scale invasion. Given the country's significant competitive advantages in this sector compared to its competitors, companies are able to make excessive profits on the foreign market, and domestic suppliers have access to cheap food. As for budget revenues, they come primarily both directly, through taxes paid by farmers, and indirectly, through the creation of jobs and other benefits for the country. Official data on budget revenues and expenditures disaggregated by enterprises are not available in open sources. Nevertheless, some information can be

used for analysis. For example, Figure 4 below shows the amount of expenditures on the agricultural sector from the Ukrainian budget.

As can be seen from Figure 4, state budget expenditures in Ukraine are gradually increasing, although in real terms (adjusted for inflation) they are gradually decreasing. This suggests that real support for the agricultural sector in Ukraine is declining, which may be due to both the development of the sector itself and the reduced capacity of the state to finance it. As for the revenues that were transferred to the budget from the agricultural sector, such data is not available in official sources. Nevertheless, they can be calculated from the net financial result of companies in the sector, as shown in Figure 5.

As shown in Figure 5, the profits of agricultural enterprises have indeed been growing over time, including after adjusting for inflation. This generally indicates a real development of the sector over time, which partially justifies the reduction of state support. The calculation of the amount of taxes paid by enterprises compared to their expenditures is shown in Figure 6.

As can be seen from Figure 6, in 2010 the agricultural sector was still in need of external assistance from the state. However, since 2015, the sector has become surplus, i.e. it has started to generate revenues for the state budget. This can also be seen in Figure 7.

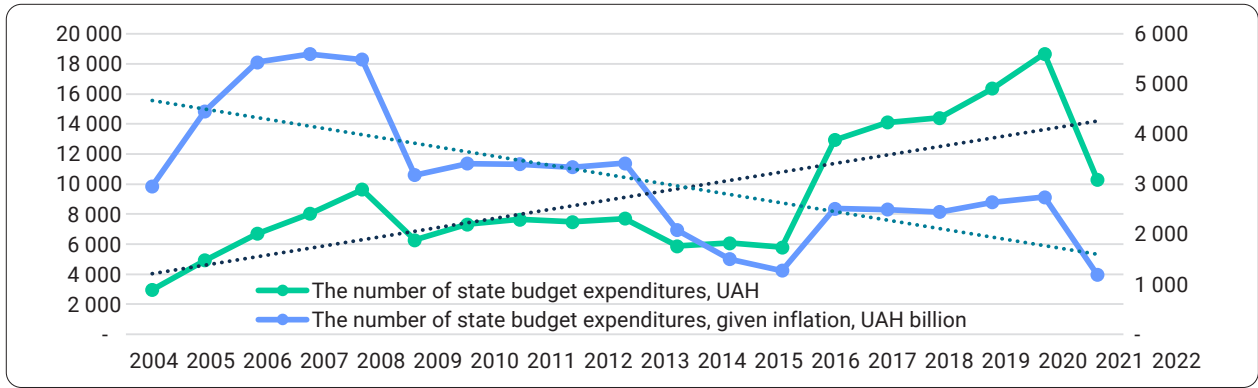


Figure 4. Volumes of state budget expenditures on the agricultural sector in Ukraine in the period from 2004 to 2022, taking into account inflation, UAH billion

Source: compiled by author based on the data from Expenditure by function (n.d.)

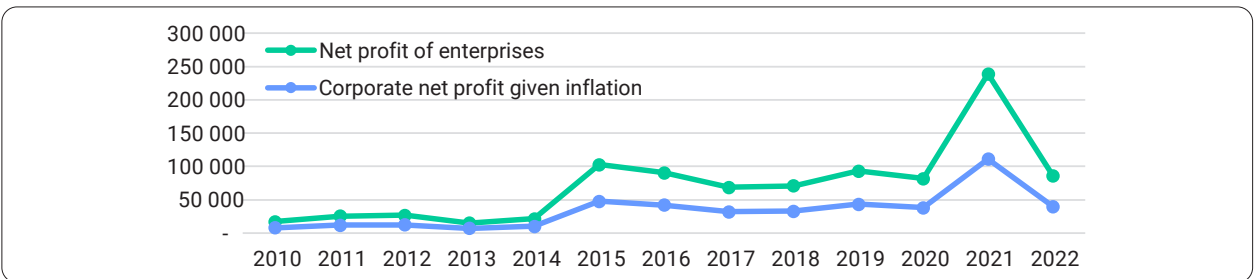


Figure 5. Net profit of agricultural sector enterprises with (in 2004 prices) and without taking into account inflation in the period from 2010 to 2022, UAH billion

Source: compiled by the author based on the data from the State statistics service of Ukraine (n.d.)

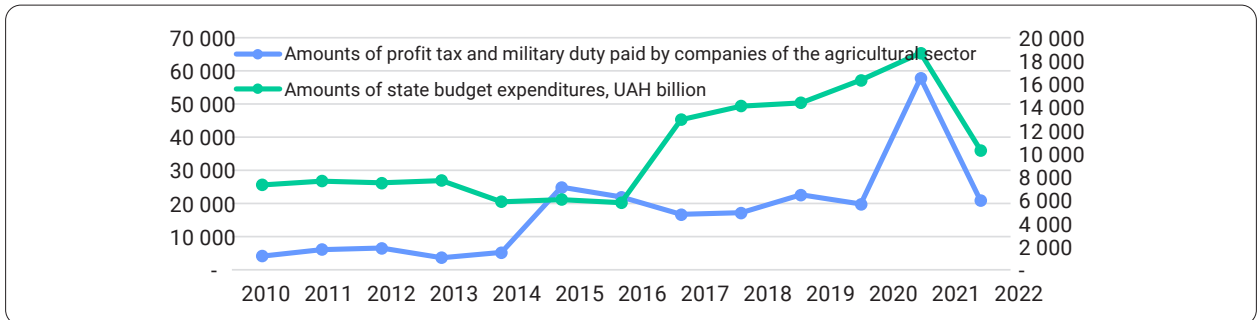


Figure 6. Amounts of taxes paid by agricultural sector enterprises and budget expenditures for this sector in the period from 2010 to 2022

Source: compiled by the author based on the data from the State statistics service of Ukraine (n.d.) and Expenditure by function (n.d.)

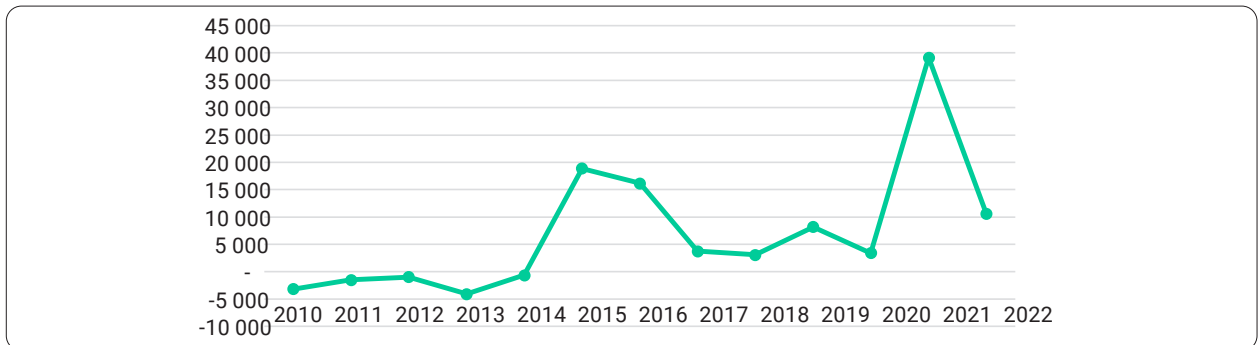


Figure 7. Volumes of net revenues to the budget of Ukraine from agricultural enterprises in the period from 2010 to 2022, million UAH

Source: compiled by the author based on the data from the State statistics service of Ukraine (n.d.) and Expenditure by function (n.d.)

Figure 7 shows that the amount of net income to the Ukrainian budget from agricultural enterprises of Ukraine really increases over time. It is also important to consider the percentage share of revenues and expenses in the Ukrainian budget, which can be seen in Figure 8:

As can be seen from Figure 8, the share of the agricultural sector in total budget revenues has increased and remains high, while the share of expenditures has decreased. It is also worth noting that the share of tax revenues from agricultural enterprises is generally significant, as even a small percentage of these revenues is

important for the budget, given its size and the level of diversification of revenue sources. All of this indicates the important role of the agricultural sector for the state budget; it also suggests that in the future this sector should be supported by the state, if not financially, then by other means, such as creating favourable conditions for its financing. Given the gradual recovery of Ukraine during the war and the existing opportunities in the post-war period, it is reasonable to assume that this industry will be the main source of budget revenues in the future.

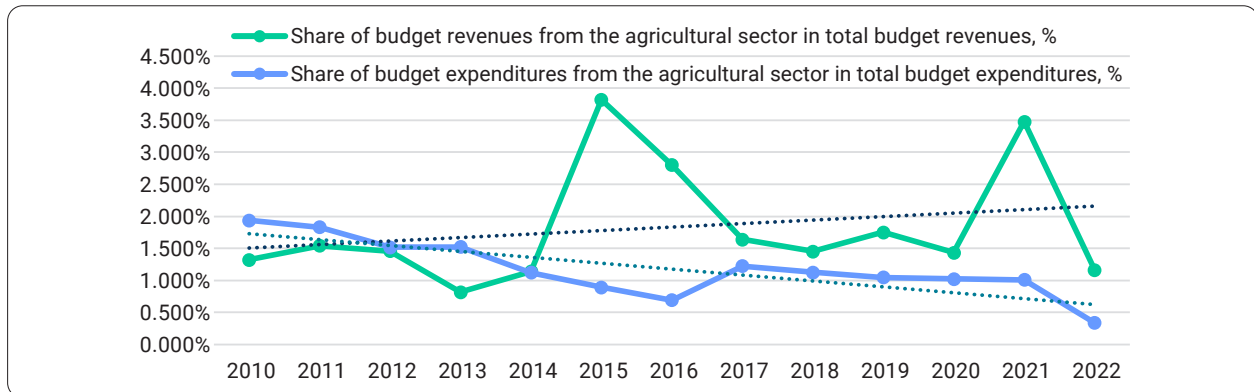


Figure 8. The ratio of budget revenues from agricultural enterprises to total budget revenues and expenditures on the agrarian sector to total in the period from 2010 to 2022

Source: compiled by the author based on the data from the State statistics service of Ukraine (n.d.) and Expenditure by function (n.d.)

Thus, it is possible to identify several problems associated with financing the budget deficit during the war. Firstly, it is a decrease in budget revenues due to a decline in economic activity, a drop in production and foreign trade. Companies, as well as individuals, start to receive lower incomes and therefore pay lower taxes, which negatively affects the country's ability to finance all expenditure items. Secondly, during a war, expenditures to finance the war, support the main economic sectors and the social component of the country (local residents) increase significantly. This increases the amount of money that the state needs to raise, and thus makes it much more difficult to do so in general. In particular, as can be seen from Figure 3 above, expenditures in Ukraine almost doubled in 2022: it is impossible to increase budget revenues in such a period and in such volumes. Thirdly, as mentioned above, during the war, the debt burden increases, which is absolutely necessary to finance current expenditures, but, if prolonged, may make it more difficult to repay the debts incurred, and thus further complicate the situation in the country. Another complication is that the country is generally becoming much less attractive to foreign investors and companies in the context of war, which is why they are not as active in raising their own capital to build certain enterprises in its territory or investing in existing Ukrainian companies.

Nevertheless, even in such circumstances, countries have opportunities to raise additional funds to finance the

expenditure side of the budget. It is of great importance for financing the budget deficit in times of war: it helps to maintain the country's financial stability and fulfil financial obligations to creditors, as well as to meet the social needs of the population and protect vulnerable groups, maintain economic stability, carry out necessary reforms and modernize the economy. In addition, it generally helps to strengthen international partnership in the fight against the military conflict. This type of financing is the most acceptable, as international organizations and countries often provide funds at a lower interest rate, on a grant basis, or without any requirement for repayment. Any other type of financing is inferior in such circumstances. For example, raising taxes will lead to an even more rapid deterioration of the economy, which may eventually lead to an impossible business environment and complete shadowing of business. It could also lead to increased discontent among the population, which is also dangerous in times of war.

One of the possibilities for financing the state budget is also the use of market instruments, namely bonds (both those denominated in the national currency and foreign currencies (Eurobonds)). In recent years, external financing (which includes loans from international financial institutions and the sale of budget assets) has accounted for a significant share of total debt. Its growth in the long run would lead to a debt danger for the country, which would require significant attention from the government.

Nevertheless, in times of war, such negative components become less important, as the urgent need to find funds to cover certain immediate expenses becomes more important than the long-term well-being and the ability to repay debts to investors in the future. However, it is also impossible to recommend using this instrument too actively. It should be used by the Ministry of Finance regularly at auctions to cover urgent expenditures, or on a planned basis, but it really should not be overused, at least because the assistance provided by international partners (organizations or countries) often has much better terms than those that would be obtained in the case of a bond issue. Therefore, the primary goal of both the Ministry of Finance and the country as a whole should be to fulfil all the necessary conditions for receiving assistance from them.

The role of the agricultural sector in the war also remains significant. As shown above, in the context of conflict and the economic problems it brings, the sector becomes an instrument for ensuring financial stability and resilience, at least in Ukraine. It is the payment of taxes by companies in the sector that makes it possible to fulfil obligations to creditors, preventing the country from falling into a debt trap. In addition, these funds are key to meeting social needs and protecting vulnerable groups of the population. All of this makes it possible to attract foreign investment in the sector, thereby strengthening international relations with other countries and ensuring the development of the sector as a whole. Such a policy will ensure sustainable growth of the industry, which in turn will generate revenues for the budget, reducing its debt burden and maintaining long-term sustainability.

Discussion

As part of their work, S.H. Law *et al.* (2021) studied the impact of public debt on economic growth in seventy-one developing countries over the period 1984-2015. The researchers identified a threshold level of debt of 51.65% of GDP, below which public debt has little impact on economic growth, and above which it has a negative and statistically significant impact. The findings suggest that policymakers should consider introducing a debt ceiling to prevent excessive debt levels that could harm economic growth. This suggests that it is important to understand the dynamics of public debt in a country for its more effective management, as well as its impact on economic growth for the development of effective fiscal policy. It is worth noting that the above study also found a negative correlation between the level of public debt and gross domestic product, which may indicate its overall negative impact on economic growth. A similar study was conducted by S.T. Onifade *et al.* (2020) on the impact of government spending on economic growth in Nigeria from 1981 to 2017. The findings showed that there is a long-term relationship between economic growth and public spending. It was shown that current government spending and public debt have a significant negative impact on economic growth, while capital government spending has a positive

but insignificant impact. This means that economic growth cannot be sustained solely by current expenditures and debt financing without fiscal discipline and sufficient investment in capital projects. Thus, they recommended controlling current expenditures, fighting financial corruption and diversion of funds, and ensuring transparency of capital expenditures to maximize profits. All these recommendations are generally relevant for Ukraine, but rather in the long term: after the end of hostilities and the first stages of recovery (which will require a completely different policy related to tax liberalization and increased economic activity).

N.A. Desdiani *et al.* (2022) studied the impact of the COVID-19 crisis on local government budgets in different provinces of Indonesia (based on a survey among them). It was shown that the responses of local governments differed depending on factors such as the number of COVID-19 cases, fiscal capacity, budget efficiency, and revenue generation opportunities. To ensure the sustainability of local authorities, the researchers recommended preparing for emergency expenditures, diversifying revenue sources, increasing capital expenditures, and investing more in soft infrastructure. Although local budgeting has some common features with state budgeting, they are still different, and therefore the recommendations and principles outlined above cannot be fully applied in Ukraine, especially in the short term. S. Park & C.S. Maher (2020) assessed the peculiarities of state governance during a crisis, in particular, during COVID-19. The authors pointed out that the pandemic challenged the conventional concept of fiscal federalism, which argued that policy is effective when it is implemented in a decentralized manner. However, in the case of COVID-19, a more centralized and single, consistent message from the national government has led to significant differences in the number of confirmed cases and deaths. It is worth noting that such shortcomings are not the same for all types of crises. For example, the crisis that arose in Ukraine because of the war demonstrates completely different performance indicators: due to the decentralization of power among the military, the effectiveness of actions to counter the enemy was more efficient, as it allowed not to wait for confirmation of the correctness of certain actions in certain areas of the front. As for the economic component, it is difficult to draw any conclusions on this issue: although the country's economic development is quite centralized, local authorities have a high level of autonomy. This independence in their own actions has made it possible to minimize the negative consequences of the war for Ukraine.

An interesting study on the dependence of elected ministers of finance on the budget deficit in Germany was conducted by B. Jochimsen & S. Thomasius (2014). The study showed that professional experience does matter in terms of how effectively budget funds were managed: ministers of finance with experience in the financial sector achieved lower deficit indicators than those without such experience. At the same time, education or speciality, or

certain characteristics acquired at birth (gender, country of origin, and age) did not play a significant role. At the same time, the length of time in office played an important role: for example, ministers of finance who served longer achieved lower deficit levels; this effect was particularly noticeable when the minister of finance and the prime minister belonged to the same party. Nevertheless, party affiliation alone did not make a significant difference in how well the budget was managed. All of these factors suggest that, in general, for more effective financial management in a country, it is better to elect a person with practical experience in this area rather than candidates with a good education. It can be assumed that this logic will be relevant for all other ministry employees (in less important positions). It is worth noting that this logic may not work in Ukraine, or may be different, since the empirical study was conducted for Germany. Nevertheless, given the geographical proximity of the countries and the lower quality of education in Ukraine in comparison, it is likely that its role in governance efficiency will be even lower than in Germany. Therefore, when selecting candidates, it is important for government agencies to pay attention to the experience of employees and their level of qualification.

A. Orji *et al.* (2020) assessed agricultural financing and agricultural production growth in developing countries in their study. They showed that public funding of agriculture does not directly affect production growth in this sector. According to the statistics, the growth of agricultural production does not correlate with changes in the level of public funding. In this regard, the researchers made several recommendations, namely to improve access to credit for farmers who often have problems with collateral. In addition, it is important to increase the transparency and effectiveness of major local programmes, which can also benefit small farmers and relevant stakeholders. In other words, the researchers believe that it is more important to create favourable conditions for farmers than to provide them with funds. The interaction between the state budget and agriculture has also been studied by S. Pandit & S.C. Dhakal (2022). The research showed that only up to 3 per cent of the total budget has been allocated to the agricultural sector in recent years in Nepal. They note that such support is insufficient, despite the fact that the contribution of agriculture to GDP is declining. The opposite situation is observed in Ukraine, where the contribution of agriculture to gross domestic product is gradually increasing. Nevertheless, government support for the sector remains low. Trends in the distribution and use of the budget for the agricultural sector were also studied by O. Adeyemi *et al.* (2023). They pointed out the changing role of agriculture, as well as the changes observed in terms of budget revenues. It is worth noting that similar changes were observed in Ukraine: it was noted that in the year of the COVID-19 crisis, the income of agricultural enterprises increased, which was caused by both high yields and rising prices for these products in the world. Thus, during the war in Ukraine, increasing budget revenues

is a big responsibility for the state authorities. Moreover, it is a difficult task, as armed conflicts generally have the worst impact on economic development and the state of the country as a whole, preventing businesses from developing, creating added value and collecting taxes. The main sources for this are international support, as the country cannot provide for itself on its own, or only by issuing national currency, which also has a negative impact on the welfare of citizens and economic development. The agricultural sector also remains an important component of budget revenues, but it should be understood that in a time of war, corporate tax revenues will not be able to fill the budget sufficiently, and therefore, the focus should be on obtaining international financing. That is why the high-quality work of diplomats and the ability to enter into new alliances with international partners during the war is one of the most important components of the country's effective recovery from the difficult economic situation during such conflicts.

Conclusions

The aim of the paper was to assess the existing problems related to the financing of the Ukrainian budget and to propose methods to improve the current situation, in particular, at the expense of the public sector. The paper shows that the main problems of the sector are a significant increase in expenditures due to the war, as well as a gradual increase in its debt, which may lead to significant negative consequences in the long run. This is due to the growing role of foreign aid, which is often in the form of loans. While international support and market instruments, such as bonds, are important for mitigating the economic consequences of the war, they will also play a significant role in the long run, which should also be taken into account when formulating public budget management policies.

The structure of budget revenues analysed in this paper highlights the importance of value added tax, personal income tax, excise tax, and corporate income tax in the budget. In this context, the agricultural sector has become critically important in supporting Ukraine's budget, especially during the period of conflict and economic difficulties. The sector's competitiveness allows companies to earn excessive profits on foreign markets and Ukrainian suppliers to have access to affordable food. The sector's contributions to the budget are twofold: direct tax payments by farmers and indirect benefits, including job creation and economic stimulus. Over time, the share of agricultural revenues in the budget has grown significantly, as has its role in the country's welfare. This suggests that support for the agricultural sector, both financial and otherwise, is crucial for the stability of Ukraine's budget, especially given the needs of post-war reconstruction.

An assessment of foreign experience in terms of ensuring state budget financing in crisis conditions, including military ones, is relevant for future research. In addition, it remains important to find other opportunities to improve the efficiency of public authorities in Ukraine.

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Conflict of Interest

None.

References

- [1] Adeyemi, O., Adesiyun, Y., Omenka, S., Ezekannagha, O., Adanlawo, A., Oyeleke, R., Umunna, L., Aminu, F., Onabolu, A., & Ajieroh, V. (2023). Government budget for nutrition-sensitive agriculture in Nigeria increased following development of related strategy. *Food and Nutrition Bulletin*, 44(1), 103-114. doi: [10.1177/03795721231179783](https://doi.org/10.1177/03795721231179783).
- [2] Chugunov, I., Pasichnyi, M., & Nikitishin, A. (2022). State budget revenues of Ukraine under martial law. *Scientia Fructuosa*, 145(5), 124-137. doi: [10.31617/1.2022\(145\)08](https://doi.org/10.31617/1.2022(145)08).
- [3] Desdiani, N.A., Sabrina, S., Husna, M., Budiman, A.C., Afifi, F.A.R., & Halimatussadiyah, A. (2022). Local budget resilience in times of COVID-19 crisis: Evidence from Indonesia. *Economies*, 10(5), article number 108. doi: [10.3390/economies10050108](https://doi.org/10.3390/economies10050108).
- [4] Dmytriieva, V., & Sviatets, Y. (2021). Turning points in agriculture development in Ukraine: Results of analysis on the base of purified data. *Agricultural and Resource Economics*, 7(1), 5-21. doi: [10.51599/are.2021.07.01.01](https://doi.org/10.51599/are.2021.07.01.01).
- [5] Dziurakh, Yu. (2019). State regulation of investments in agriculture: Foreign experience and possibilities of its implementation in Ukraine. *Efficiency of Public Administration*, 1(58), 220-231. doi: [10.33990/2070-4011.58.2019.168739](https://doi.org/10.33990/2070-4011.58.2019.168739).
- [6] Expenditure by function. (n.d.). Retrieved from <http://old.cost.ua/budget/expenditure/>.
- [7] Hantsiak, M. (2022). Current state of attracting budget deficit financing on the market of state debt securities of Ukraine. *Economy and Society*, 44. doi: [10.32782/2524-0072/2022-44-17](https://doi.org/10.32782/2524-0072/2022-44-17).
- [8] Hashemizadeh, A., Bui, Q., & Kongbuamai, N. (2021). Unpacking the role of public debt in renewable energy consumption: New insights from the emerging countries. *Energy*, 224, article number 120187. doi: [10.1016/j.energy.2021.120187](https://doi.org/10.1016/j.energy.2021.120187).
- [9] Jochimsen, B., & Thomasius, S. (2014). The perfect finance minister: Whom to appoint as finance minister to balance the budget. *European Journal of Political Economy*, 34, 390-408. doi: [10.1016/j.ejpoleco.2013.11.002](https://doi.org/10.1016/j.ejpoleco.2013.11.002).
- [10] Law, S.H., Ng, C.H., Kutan, A.M., & Law, Z.K. (2021). Public debt and economic growth in developing countries: Nonlinearity and threshold analysis. *Economic Modelling*, 98, 26-40. doi: [10.1016/j.econmod.2021.02.004](https://doi.org/10.1016/j.econmod.2021.02.004).
- [11] Onifade, S.T., Çevik, S., Erdoğan, S., Asongu, S., & Bekun, F.V. (2020). An empirical retrospect of the impacts of government expenditures on economic growth: New evidence from the Nigerian economy. *Economic Structures*, 9, article number 6. doi: [10.1186/s40008-020-0186-7](https://doi.org/10.1186/s40008-020-0186-7).
- [12] Orji, A., Ogbuabor, J.E., Anthony-Orji, O.I., & Nkechi Alisigwe, J. (2020). Agricultural financing and agricultural output growth in developing economies: Any causal linkage in Nigeria? *International Journal of Finance, Insurance and Risk Management*, 10(2), 34-43. doi: [10.35808/ijfirm/213](https://doi.org/10.35808/ijfirm/213).
- [13] Pandit, S., & Dhakal, S.C. (2022). Recent trends on allocation and utilization of budget for agriculture sector in Nepalese budgetary plan. *Food and Agri Economics Review (FAER)*, 2(2), 85-87. doi: [10.26480/faer.02.2022.85.87](https://doi.org/10.26480/faer.02.2022.85.87).
- [14] Park, S., & Maher, C.S. (2020). Government financial management and the coronavirus pandemic: A comparative look at South Korea and the United States. *The American Review of Public Administration*, 50(6-7), 590-597. doi: [10.1177/0275074020941720](https://doi.org/10.1177/0275074020941720).
- [15] Sadik-Zada, E.R., & Gatto, A. (2019). Determinants of the public debt and the role of the natural resources: A cross-country analysis. *FEEM Working Paper*, 4. doi: [10.2139/ssrn.3364174](https://doi.org/10.2139/ssrn.3364174).
- [16] Shumska, H. (2023). Elaborating the directions for ensuring the effectiveness of public administration as a basis for socioeconomic development of Ukraine. *Business Inform*, 1, 177-184. doi: [10.32983/2222-4459-2023-1-177-184](https://doi.org/10.32983/2222-4459-2023-1-177-184).
- [17] State debt of Ukraine. (2023). Retrieved from <https://index.minfin.com.ua/ua/finance/debtgov/>.
- [18] State statistics service of Ukraine. (n.d.). Retrieved from <https://ukrstat.gov.ua/>.
- [19] Statistical collection. (2022). Retrieved from <https://mof.gov.ua/uk/statistichnij-zbirnik>.
- [20] Sulimenko, L., & Viter, S. (2019). Information providing of income management the united territorial communities. *Scientific Horizons*, 3(76), 48-56. doi: [10.33249/2663-2144-2019-76-3-48-56](https://doi.org/10.33249/2663-2144-2019-76-3-48-56).
- [21] Vasylykivskiy, D., Trubnik, T., & Bykova, M. (2023). Economic benchmarks for Ukraine in the context of global economic development prospects in 2023-2024. *Academic Visions*, 17. doi: [10.5281/zenodo.7791169](https://doi.org/10.5281/zenodo.7791169).
- [22] Verheliuk, Yu. (2022). Using market sources for financing the state budget deficit in Ukraine. *Scientific Notes of Ostroh Academy National University, "Economics" Series*, 24(52), 84-89. doi: [10.25264/2311-5149-2022-24\(52\)-84-89](https://doi.org/10.25264/2311-5149-2022-24(52)-84-89).
- [23] Zakhohzhay, K., & Kravchenko, I. (2019). Budget financing of agriculture in Ukraine. *Agrosvit*, 22, 84-91. doi: [10.32702/2306-6792.2019.22.84](https://doi.org/10.32702/2306-6792.2019.22.84).

Проблеми фінансування дефіциту державного бюджету

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Анотація. В умовах повномасштабного вторгнення росії, аграрний сектор залишається одним із основних джерел фінансування бюджету в Україні, а отже й потребує більш детального вивчення в умовах війни в даному контексті. Таким чином, метою роботи стало оцінити актуальні можливості фінансування українського бюджету з акцентом на ролі аграрного сектору в дохідній та видаткових його частинах. Основними методами дослідження стали аналіз, прогнозування, абстрагування, історичний, статистичні методи, а також графічний. Під час дослідження була проаналізована динаміка українського бюджету та описаний загальний негативний тренд, що спостерігається з часом. Було проаналізовано можливі сфери залучення коштів для фінансування, зокрема за рахунок облігацій як внутрішніх, так і зовнішніх; було сформувано висновок про небажаність використання подібних методів. Також в рамках роботи було показано, що аграрний сектор в Україні став суттєвим джерелом поповнення бюджету країни в умовах війни. Наявна у доступних джерелах інформація вказала на те, що частка доходів, що отримуються з аграрного сектору, в бюджету України є досить високою, а сама сфера є профіцитною (доходи від неї перевищують видатки). Зважаючи на вигоду для бюджету від розвитку аграрного сектору, актуальною залишається його підтримка з боку держави як фінансовими, так і нефінансовими методами. Результати роботи можуть використовуватися державними діячами під час ведення управлінської діяльності в рамках країни чи регіонів, а також керівниками підприємств при побудові довгострокових стратегій розвитку

Ключові слова: борг; міжнародні відносини; макроекономіка; менеджмент; аграрний сектор; підприємництво

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Directions for increasing the efficiency of the company's cash flow management

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Abstract. The problem of managing the enterprise's cash flows is relevant, since the successful management of these resources is the key to the financial security and stability of any business entity. The purpose of the study was to identify universal recommendations for improving the enterprise's cash flow management by generalizing the theoretical aspects of cash flow management and analysing the cash flows of PJSC "Odesa Cognac Factory". The following methods were used in the study: systematization and generalization (theoretical aspects were studied and existing views of scientists on the essence and management of cash flows were summarized), factor analysis (key financial factors influencing the process of enterprise cash flow management were identified), coefficient analysis (analysis of the efficiency of enterprise cash flow management was carried out). Using the example of the operating enterprise PJSC "Odesa Cognac Factory", the dynamics of changes in the key components of cash flow management is analysed and the existing gaps in their management are identified. The carried out analysis allowed identifying possible directions for improving the efficiency of cash flow management of the enterprise and to provide certain recommendations, as a result of implementation of which the enterprise will have a positive impact on its further activities, namely: focusing on optimization of available cash flows and their balancing; studying the regularity of their movement in the enterprise by calculating the liquidity and solvency indicators; considering the possibility of introducing the use of budgeting and financial management in the enterprise as additional tools for managing cash flows; creation of an independent department for controlling the movement of available cash flows; use of reliable and timely accounting information on cash flows when making certain management decisions due to the increased use of modern information technologies. The practical value of the study is

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the universal nature of the recommendations provided for the implementation of measures to improve the efficiency of cash flow management, since these recommendations can also be used by other similar enterprises

Keywords: influencing factors; cash; income and expenses; balance; synchronism; recommendations

Introduction

Modern companies ensure an appropriate level of solvency by balancing the amount of available cash inflows and outflows, synchronizing them in the course of their development, and cash flow management is a crucial component of their financial policy, which involves the constant participation of all key parts of the management system. Changes in the dynamics of the company's cash flows result in certain decisions regarding its operations. It is impossible to overestimate the importance and significance of cash flow management, as the stable state of an enterprise is affected not only by its quality and efficiency, but also by its ability to further develop and financial security. Effective cash flow management can help a company achieve a better bottom line and become more profitable. This determines the relevance of the issue of effective cash flow management, which includes ensuring appropriate financial balance, and the need to develop and provide recommendations for improving the efficiency of enterprise cash flow management.

In today's environment, Ukrainian and global companies face the need to improve the efficiency of cash flow management, which has directly prompted a significant number of experts and scholars to continue researching significant problems related to cash flow. Thus, among the modern researchers of this issue, it is worth noting O.O. Oliynyk (2021), who devoted his work to defining the essence of cash and financial flows as economic categories, and their distinction when applied in theory and practice in relation to certain phases of the process of expanded reproduction in the system of modern financial management of enterprises.

Theoretical aspects are also addressed by G.S. Melnychuk (2020), A.V. Buryak & I.V. Demyanenko (2019), who reviewed the methods and systematized the coefficients used in the analysis of enterprise cash flows. Issues related to cash flow planning are paid attention to in the works of V.V. Skryl & K.Yu. Stupenko (2018), O.I. Dorosh & I.V. Plish (2021), in particular, the latter noted that the formation of cash flows should be based on the use of a number of tools, which must include a payment calendar, budget and cash flow plans, identify the features of planning the company's cash flows and build a clear sequence of this process. T.G. Shchepina & A.D. Titarenko (2021), as well as I. Spilnyk & O. Zagorodna (2017) and O.V. Krylova (2019). T.O. Mulyk (2022) paid attention to the relevance of improving the efficiency of enterprise cash flow management, which, in her opinion, is due to the contradiction between the growing needs of economic resources and their limited availability.

I.V. Piskuleva & M.I. Mavrina (2022) consider models of cash balance management, reveal the main issues of the

relationship between the efficiency of their management and maintaining the required optimal level of liquidity. Substantiation of the parameters for optimizing the enterprise's cash flows was carried out by G. Azarenkova *et al.* (2022). V.V. Malikov (2020) devoted his work to practical recommendations for managing the cash flows of an enterprise, emphasizing that when using these recommendations in practical conditions, it becomes possible not only to reduce time costs but also to build a realistic cash flow management system. The author believes that the main tool for accounting for cash flows for their proper management is the Information Statement on Cash Flows.

The purpose of this study is to analyse the state of management of its cash flows and identify areas for possible improvement of efficiency of cash flow management, which may be effective for other companies, based on generalization of theoretical and methodological aspects of cash flow management and on the example of a real operating enterprise – PJSC Odesa Cognac Factory. To achieve this goal, the following tasks were set: to systematize the existing views on cash flow and determine the importance of cash flow management as a component of a company's financial activities; to identify the key factors that influence the process of managing the company's cash flows; to analyse the current state of cash flow management at PJSC "Odesa Cognac Factory" and, using the example of this enterprise, to identify universal possible ways to improve the efficiency of cash flow management of enterprises.

Materials and Methods

The methodological basis of this study in considering the theoretical aspects of enterprise cash flow management are the methods of systematization and generalization of the existing views of scientists on the essence and management of enterprise cash flows, which allowed allocating the main components that characterize the concept of "cash flow" and comprehensively considering its essence, using the method of analysis of existing scientific developments. When considering the process of enterprise cash flow management as one of the important components of the overall system of management of financial activity of enterprise, the article uses factor analysis, which allowed identifying key financial factors of influence on the process of enterprise cash flow management and importance of their balance. Using the graphical method, the article builds a graph of balance (synchronization) of cash flows and analyses the efficiency of management of its cash flows on the example of a real enterprise. Thus, the construction of a graph of the balance (synchrony) of cash flows of PJSC "Odesa Cognac Factory" for the period 2019-2022 showed

the existing unevenness of receipts and expenditures of its cash flows for the analysed period, which is due to the seasonal nature of the company's activities.

The ratio analysis was carried out by calculating the key indicators that characterize the quality of cash flow management, namely the calculation of the following ratios: cash flow liquidity, cash flow efficiency, net cash flow sufficiency, net cash flow profitability, return on cash received, return on cash spent, and accounts receivable turnover. The analysis of the cash flow efficiency of PJSC "Odesa Cognac Factory" for 2019-2022 was carried out using the following formulas:

Indicator	Calculation formula
Cash flow liquidity ratio	$Cflr = \frac{CF+}{CF-}$
Cash flow efficiency ratio	$Cfer = \frac{NCF}{CF-}$
Net cash flow adequacy ratio	$Ncfer = \frac{NCF+}{O+\Delta Res+D}$
Net cash flow rate of return	$Ncfr = \frac{NP}{NCF}$
Rate of return on cash received	$Ncfr = \frac{NP}{NCF}$
Rate of return on money spent	$Rrms = \frac{NP}{CF-}$
Accounts receivable turnover ratio	$Artr = \frac{NI}{Rs}$

where (CF+) – positive cash flow; (CF-) – negative cash flow; NCF – net cash flow; O – the amount needed to repay obligations; Δ – increase in reserves; D – the amount of dividends paid to shareholders; NP – net profit; NI – net income from the sale of products; Rs is the average value of receivables for the analysed period.

The assessment of the volume and structure of cash flows of PJSC "Odesa Cognac Factory" was carried out for 2019-2022 on the basis of the company's financial statements (Financial statements of PJSC "Odesa Cognac Factory" for 2019-2022), which made it possible to assess the state of cash flow management of this company and identify universal possible ways of increasing the efficiency of cash flow management that can be used by other enterprises.

Results and Discussion

To ensure the profitability of the company, management manages available cash flows. Financial assets are the

basis of all areas of the company's operations, regulating the cash flow process at all stages, increasing liquidity, solvency and ensuring the economic stability of the company. Capacity and liquidity undoubtedly depend on the ability to control cash flows in a timely manner and in accordance with the needs. All enterprises need to implement a holistic concept of planning, controlling, and modelling cash flow management. O.I. Dorosh & I.V. Plish (2021) formulated a general definition of cash flow and noted that "the cash flow of an enterprise is the receipts and payments, that is, the continuous movement of funds in the enterprise in the process of financial, investment and operating activities; it is the most liquid asset".

In turn, cash flow management is one of the most important segments in the financial work of an enterprise, and not only current but also future performance and further future development of any enterprise depend on the efficiency of its organization. To achieve the desired result of the company's activities, it is important to monitor its financial condition in a timely manner and respond quickly to negative indicators. Information on the financial condition of the company should be an integral part of its cash flow management, and the process of cash flow management should be carried out within the framework of the economic and financial policy of the company, and be a key tool for achieving the main goal of the company's activities – increasing annual profit to increase the welfare of capital owners by increasing the market value of the company.

Business operations of an enterprise are accompanied by cash flow, which provides an estimate of income, expenses, movement of financial sources and assets. The process of capital flows occurs in time and space in the course of economic activity. The level of economic efficiency depends on the availability of cash resources, integrity, and timeliness of the production and sales process. The cash flow of an enterprise is characterized by total income and expenses secured by cash receipts and payments, as well as by the corresponding positive and negative changes. Based on the existing definitions of scientists and the above descriptions, the main components that characterize the concept of "cash flow" can be identified (Fig. 1).

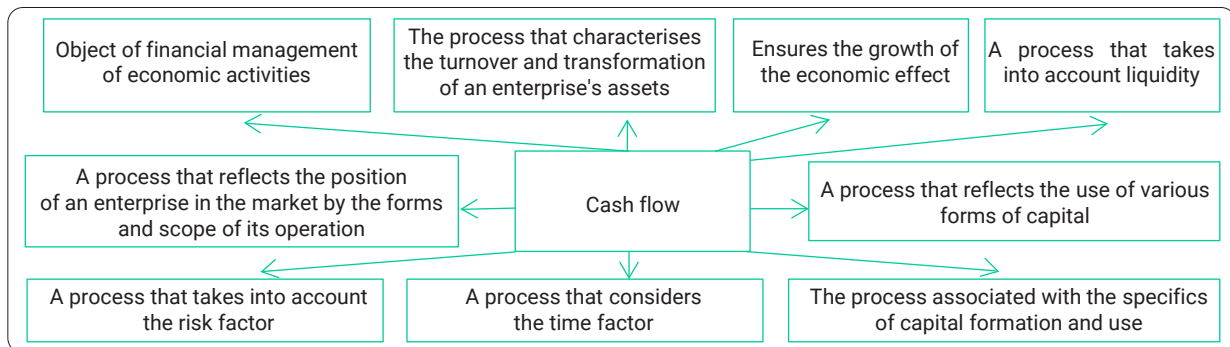


Figure 1. Basic characteristics of the concept of "cash flow" of the enterprise

Source: developed by authors based on research O.V. Krylova (2019), T.O. Mulyk (2022), G.S. Melnychuk (2020)

In any case, cash flow refers to the actual amount of cash receipts and payments generated in the course of the economic system, distributed in space and time, in terms of economic and production, organizational and economic, and internal economic relations. Enterprise cash flow management is an important component of the overall system of management of all financial activities of the enterprise,

which allows solving various financial management tasks and is a key process towards achieving the main goal of the enterprise. Effective management of the enterprise's cash flows is a key factor in increasing its capital, i.e. the profitability of the enterprise directly interacts with the cash flow management system, which should be implemented at the enterprise through certain stages (Fig. 2).

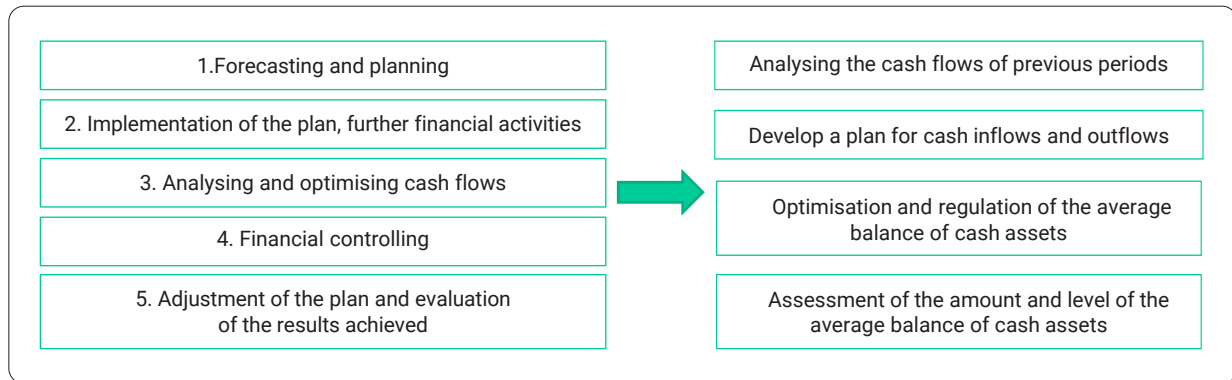


Figure 2. Stages of enterprise cash flow management

Source: Developed by authors based on research A.V. Buryak & I.V. Demyanenko (2019), O.I. Dorosh & I.V. Plish (2021), O. Guseva *et al.* (2021)

It should be noted that the first stage involves planning cash flows by their various types based on the results of the previous period's cash flows. This planning is predictive in nature due to the uncertainty of several of its initial prerequisites and is carried out through various planned calculations of certain indicators for different possible development scenarios (realistic, optimistic, pessimistic). The purpose of the second stage is to ensure complete and reliable accounting of the company's cash flow statements. This phase of management is aimed at implementing its principles of information probability. In the process of implementing this phase of cash flow management, coordination of functions and tasks of the accounting and financial services of the enterprise is ensured. The main purpose of the third stage is to analyse the determination of capital adequacy, capital efficiency, and the balance of positive and negative cash flows of the enterprise in terms of quantity and time.

Cash flow analysis is carried out for the enterprise as a whole, for individual structural units (responsibility centres), and by the main type of its economic activity. Optimization is one of the most important components of cash flow management and is aimed at improving efficiency in future periods. The most important tasks that are solved at this stage of the cash flow management process are: timely identification and implementation of reserves to reduce the company's need to use external sources of financing; ensuring a more complete balance of positive and negative cash flows in terms of time and volume (Krylova, 2019).

The fourth and fifth stages are the results of fulfilling the set targets, forming funds and spending them

in the established direction, analysing the formation of cash flow over time, calculating liquidity and cash flow efficiency. These indicators are tracked in the process of monitoring the current financial performance of the company. The stable and efficient operation of modern enterprises is hampered by many problems, including the national economy, which is generally in crisis, insufficient supply of raw materials for processing enterprises, parity relations between raw material producers, fierce competition, lack of proper support from the state, poor quality of finished products, etc. There are also problems associated with inefficient cash flow management. It is the efficiency of cash flow management that determines the further and ultimate development of the business and the results of its financial and economic activities. In particular, a high-quality organization of the company's financial and economic control system will increase efficiency, optimize the use of resources, and thus maximize the profit of PJSC Odesa Cognac Factory.

The process of cash flow management is consistent and includes: setting certain tasks and their subsequent implementation, preliminary study and comprehensive analysis of the company's available cash flows, namely, determining the level of their balance, sufficiency, and efficiency of use. An important step in analysing cash flows is to assess their balance, i.e. the synchronization of incoming and outgoing cash flows, as well as to study the dynamics of the net cash flow indicator. The dynamics of cash flows of PJSC "Odesa Cognac Factory" is shown in Figure 3.

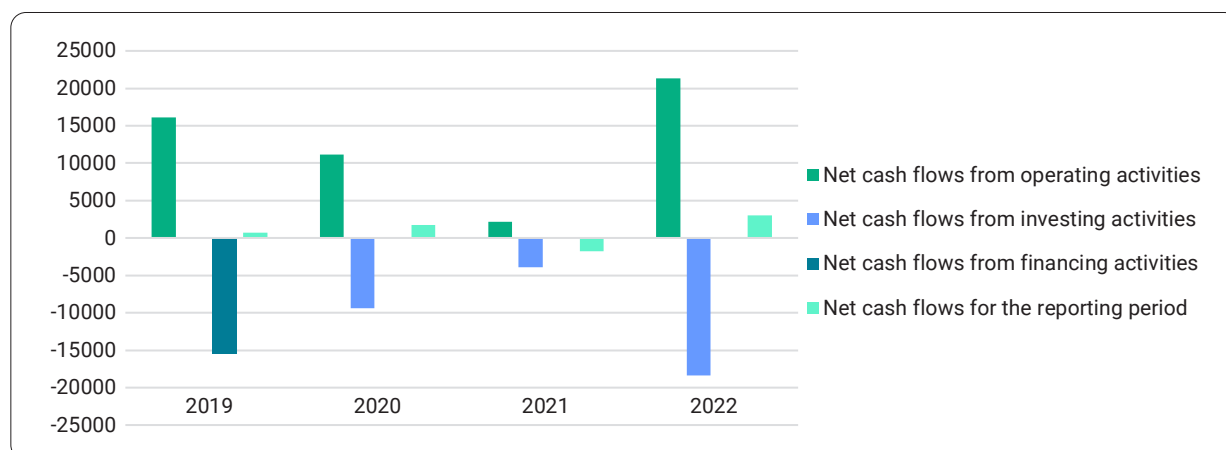


Figure 3. Dynamics of cash flows of PJSC "Odesa Brandy Plant" by types of activity for the period 2019-2022, thousand UAH

Source: compiled and calculated by the authors based on financial statements of PJSC "Odesa Cognac Plant" for 2019-2022 (n.d.)

As can be seen from Figure 3, the amount of the company's cash flows for all types of activities, according to the data for 2019-2022, tended to decrease until 2022. In 2022, there was a slight positive net cash flow. However, it is worth noting that, given the production needs, PJSC Odesa Cognac Factory, despite the instability of the total net cash flow, has fairly stable net cash flow from operating activities. For example, in 2022, net cash flow from investing activities amounted to UAH (-18 367) thousand, which indicates that the company is actively investing at the expense of loans received and proceeds from operating activities. In 2022, only operating activities demonstrated the ability to generate positive cash flow: net cash flow from operating activities amounted to UAH 2 994 thousand.

Negative cash flow from investing activities is a natural state for the company, and as of 2020 and 2021, the value of the indicator was UAH (-9403) thousand and UAH (-3946) thousand, respectively. An important quantitative indicator of economic activity is the result of the assessment of cash flows generated by operating activities. The absolute value of operating cash flow is an important indicator for calculating the net cash flow of an economic entity and most financial indicators and ratios used in cash flow management. A risk is a situation when operating activities consistently consume more funds than they generate. Table 1 provides a detailed analysis of the company's income and expenses related to operating activities.

Table 1. Dynamics and structure of the company's positive cash flow from the operational activities of PJSC "Odesa Cognac Plant", thousand UAH

Indexes	2020		2021		2022		Dynamics	
	sum	share, %	sum	share, %	sum	share, %	2021/2020 thousand UAH	2022/2021 thousand UAH
Proceeds from: Sales of products (goods, works, services)	843 961	99.9	917 567	99.4	1 559 526	99.9	73 606	641 959
Return of advances	353	0	4 444	0.5	714	0.055	4 091	(3 730)
Other income	952	0.1	490	0.1	661	0.045	462	171
Total income	845 266	100.0	922 501	100.0	1 560 901	100.0	78 159	638 400

Source: compiled and calculated by the authors based on the financial statements of PJSC "Odesa Cognac Plant" for 2020-2022 (n.d.)

According to the calculations, there have been certain changes in cash receipts from the main activity, as in the last year and the reporting period, a significant share of cash income from operating activities is income from the sale of products (goods, works, services). The absolute amount of cash flow from such revenues increased in

2022 compared to 2021 by UAH 641 959 000, or by 69.9%, which indicates a sufficiently high quality of positive cash flow from operating activities. Also, its share in the total income increased by 0.5%. Table 2 examines the dynamics of the volume and structure of expenditures for the needs of operational activities.

Table 2. Dynamics and structure of the enterprise's cash flow from operating activities of PJSC "Odesa Cognac Factory"

Indexes	2020		2021		2022		Dynamics	
	Amount, thousand UAH	share, %	Amount, thousand UAH	share, %	Amount, thousand UAH	share, %	2021/2020 thousand UAH	2022/2021 thousand UAH
Spending on: Payment of goods (works, services)	457 606	54.9	497 120	54.0	555 671	36.1	39 514	58 551
Salary	21 100	2.5	18 854	2.0	25 830	1.7	(2 246)	6 976
Deductions for social events	5 478	0.7	4 960	0.5	6 785	0.4	(518)	1 825
Obligations for taxes and fees	296 021	35.5	326 398	35.6	547 432	35.6	30.377	221 034
Expenses for payment of advances	52 436	6.3	71 782	7.8	402 664	26.1	19 346	330 882
Other expenses	1 491	0.1	1 238	0.1	1 158	0.1	(253)	(80)
Total costs	834 132	100.0	920 352	100.0	1 539 540	100.0	86 220	619 188

Source: compiled and calculated by the authors based on the financial statements of PJSC "Odesa Cognac Plant" for 2020-2022 (n.d.)

As can be seen from Table 2, the analysed company's operating expenses in 2022 increased by UAH 619 188 thousand, which may indicate an increase in the size of this activity. There is an increase in all items of expenses, except for the item "Other expenses". The highest growth rate was achieved due to "advance" expenses. Structurally, consumer operating cash flow in 2021 and 2022 consisted mainly of payments for goods, works and services, increasing by UAH 58 551 thousand. It accounted for more than 36.1% of the total cash flow from operating activities. Also, there was an increase in capital expenditures for "Labour remuneration" by UAH 6 976 thousand, their share decreased

by 0.03%. "Tax liabilities" shows the same trend, having increased by UAH 221 034 thousand in 2022, or an increase of 67.7%. Therefore, it can be assumed that the company is restricting and controlling unreasonable expenditures on "non-emergency" needs.

The study of the factors influencing the change in the company's cash flow is part of the process of developing a cash flow management policy and will allow assessing the available internal reserves and possible external directions of the company's cash flow formation. The main factors influencing the change in the enterprise's cash flow can be divided into external and internal (Table 3).

Table 3. Financial factors influencing the company's cash flows

External factors	Internal factors
Financial policy	Financial strategy of the enterprise
The state of the country's financial system	Importance and effectiveness of investment policy
Tax policy of the state	Attracting investors
Credit policy	Depreciation policy of the enterprise
Practice of settlement operations	Duration of the financial cycle
	System of settlements with counterparties
System of targeted financing and obtaining loans	Solvency and provision of financial resources of the enterprise
	Adequate level of management of production stocks and receivables

Source: developed by the authors based on research by M.I. Iorgachova (2018)

The lack of funds for the formation and management of available cash flows, considering all external and internal factors of influence, is a key task for the financial management of any enterprise. The quality of the respective cash turnover at the enterprise is determined not only by the existing composition of cash flows, but also by the indicator of rhythmicity and synchronization of cash

inflows and outflows. The study of this aspect of the enterprise's activity is presented in Figure 4.

The obtained results of the calculations indicate the existing unevenness of cash flows inflows and outflows for the analysed period, which is due to the seasonal nature of the company's activities. PJSC "Odesa Cognac Factory" has problems with the consistency of incoming and outgoing

cash flows, as evidenced by the presence of a temporary cash deficit in 2021 and temporarily free cash balances in 2020 and 2022. Both situations have a negative impact on the company, since the presence of a temporarily free cash flow means that the company's available resources are not used, which lose their value over time under the influence of inflation and other factors, and the temporary shortage

of cash resources as a result of the non-synchronous formation of cash flows poses a risk to the company's solvency. The threat of loss of solvency by an enterprise leads to the need to increase attention to the effectiveness of cash flow management, as well as the feasibility and importance of developing and implementing special measures to normalize cash flows.

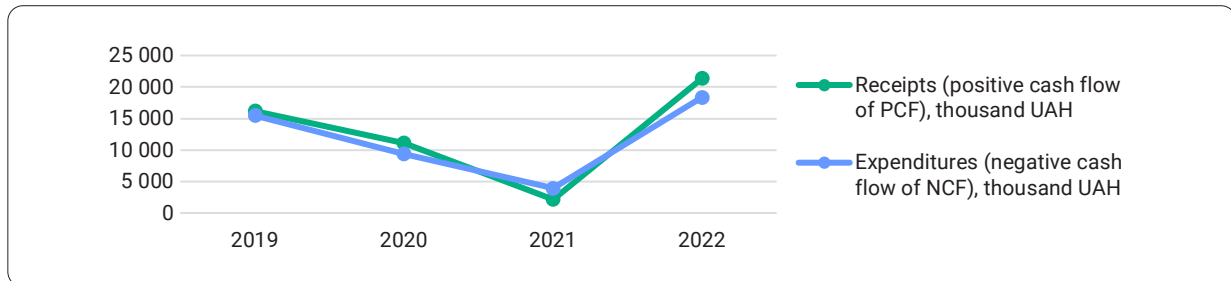


Figure 4. The schedule of balance (synchronicity) of cash flows of PJSC "Odesa Cognac Plant" for the period 2019-2022, thousand UAH

Source: compiled by the authors based on the financial statements of PJSC "Odesa Cognac Plant" for 2019-2022 (n.d.)

Thus, the analysis of the balance and synchronization of cash flow management of PJSC "Odesa Cognac Factory" showed the presence of some problems at the enterprise that require further solution: the main share in the structure of revenues is operating activities (for the last three years — 100%); the average quality of the generated cash flow of PJSC "Odesa Cognac Factory", the practical absence of cash flows from financial activities; during 2019-2022, there was an unevenness of receipts and expenditures of cash assets; for the last four years, the company has not been able to pay for the necessary measures.

Thus, the analysis of the cash flows of PJSC "Odesa Cognac Factory" showed the need for the enterprise to strive to increase the amount of incoming cash flows from operating activities, since their decrease has a negative impact on the enterprise's activities: a decrease in the volume of activities, an increase in unprofitability, deterioration of financial indicators such as liquidity and solvency, late payments of the enterprise both for wages and with suppliers, a decrease in the profitability of both the total and equity capital of the enterprise. Let analyse the efficiency of using available cash flows by calculating relative indicators and factor analysis (Table 4).

Table 4. Analysis of cash flow efficiency of PJSC "Odesa Cognac Plant" for 2019-2022

Indicator	Years			
	2019	2020	2021	2022
Cash flow liquidity ratio	1.0	1.0	0.9	1.16
Cash flow efficiency ratio	0.2	0.3	(0.2)	0.16
Net cash flow adequacy ratio	0.1	0.2	(1.0)	0.003
Net cash flow rate of return	(43.8)	5.2	(2.6)	(14.9)
Rate of return on cash received	(1.7)	3.1	2.5	(2.1)
Rate of return on money spent	2.1	4.7	(2.6)	2.4
Accounts receivable turnover ratio	1.3	1.7	0.9	1.9

Source: compiled and calculated on the basis of financial statements of PJSC "Odesa Cognac Factory" for 2019-2022 (n.d.)

Factor analysis of the activity of PJSC "Odesa Cognac Factory" allows determining the causes and consequences of the impact of certain coefficients on the main indicator – cash flow efficiency, thereby exploring the strengths and weaknesses of the enterprise in carrying out operating, investment, financial activities, and the process of accumulation and use of financial resources to ensure their effective

circulation (Vasylchak *et al.*, 2023). As shown by the calculations in Table 4, the indicator "cash flow efficiency ratio" of the enterprise "Odesa Cognac Factory" for the last four analysed years has an unacceptable value, as well as the indicators of net cash flow sufficiency and net cash flow profitability.

Based on the above calculations, it is possible to identify the necessary measures to improve the cash flow

management of PJSC “Odesa Cognac Factory”. The management should regularly analyse competitors in the domestic and foreign markets in order to increase the competitiveness of the enterprise and the quality of its products, since an increase in product sales and expansion of the product range affects the stimulation of revenues from external sources of financing, and increase the efficiency of cash flows. To pay attention to optimizing the company’s cash flows and balancing the amount of positive and negative cash flows, which will include measures to improve the quality of cash flow management at the strategic (long-term) and operational (short-term) levels. The company should reduce the amount of accounts payable and receivable. An increase in accounts receivable has a negative impact on the financial condition of the company. Therefore, managers should be interested in reducing the maturity of payments. Business entities should comply with the terms of receivables repayment in accordance with the terms of the contract and, if possible, by reducing the maturity of receivables, using partial early repayment or other means of influencing the debtor.

To make reasonable investments and use current assets to eliminate excess inventories, which can be achieved by forming the optimal amount of the company’s inventory in accordance with the needs of the company’s activities. This will enable the company to optimize its cash flows and increase its liquidity. To study cash flow patterns and calculate such indicators as liquidity, business activity, financial stability and solvency based on the results obtained, to identify problems and deviations in cash flow management in a timely manner. To determine the need for funds at the planning stage of the upcoming period, establish a system of sources of funds for the expected amount and ensure that borrowing costs are minimized. In the event of a crisis, to introduce a cash outflow saving regime, reduce production costs, modernize production, increase labour productivity, and motivate employees.

To analyse the factors that may affect cash flow against the backdrop of domestic economic conditions, uncertainty, and risks at the micro and macro levels. The company should analyse and take into account internal factors that control cash flows. Such methods include leasing, use of accelerated depreciation, accelerated collection of receivables, and synchronization of cash inflows and outflows. In addition, the development of financial models and cash flow forecasting of business entities allows for an effective response to emergencies related to strategic decision-making. Financial modelling is especially important when the availability and capacity of external financing is reduced and the risk of liquidity loss increases with a significant and disproportionate increase in receivables and payables. Financial modelling for cash flow management helps to: model the cash flows of planned activities to forecast and assess the future financial condition of the enterprise; show where funds are generated and spent; ensure consistent analytical work, create favourable conditions for operational management and make appropriate informed decisions. It

should be borne in mind that the model looks different for each enterprise, as it is influenced by the details of the financial and economic activities of a particular enterprise.

To consider the possibility of using budgeting as an element of enterprise cash flow management. The main purpose of introducing cash budgeting at an enterprise should be to determine its deficit or surplus in a timely manner. At present, most business entities do not sufficiently use modern forecasting methods, which is a negative aspect, since information support must be effective to improve the efficient movement of cash flows. One of such effective elements of strategic accounting is the budgeting process, which consists of the following main components: budgeting methods (financial planning tools: types and formats of budgets, targets and standard systems); financial structure of the company (structural department or enterprise for which the budget is prepared); budget regulations and budget control mechanisms (procedures for budgeting, submission, approval); distribution of functions among management bodies (between functional services and structural units) during the period of preparing budget; internal regulatory documents (regulations, working instructions); automation of financial calculations (which involves not only the formation of financial forecasts but also the creation of so-called continuous management accounting).

Budgeting is characterized by the fact that the choice of the budgeting system, budget forms and procedure is not established by law, but is carried out individually for each enterprise, taking into account the specific circumstances of its activities, organizational and financial structure, goals, and objectives of the budget system, completeness, functionality, degree of automation of existing processes and the amount of funds allocated for the implementation of the system. This means that each business will have different budget requirements and sizes. Practice has shown that the weakest link is often the budget execution procedures, actions, and processes aimed at achieving the targets approved in the budget during the budget period. The lack of interconnection between budgeting and management accounting systems is also a problem. The ability of the existing management accounting systems to provide the data required for planned actual analysis was not considered when formulating certain budget conditions. Organizational mistakes include: incorrect allocation of financial responsibility centres, lack of incentives related to budget indicators, inconsistent automation of budget systems, human resources and psychological problems in implementing budget systems (Melnychuk, 2020).

It is also important to improve the internal financial control system to prevent inefficient use of financial resources. Since PJSC Odesa Cognac Factory has a large production volume and sells its own products in the domestic and foreign markets, it is better for the company’s management to create an independent control department that will monitor the implementation of the budget of available cash flows through the development and implementation of certain internal reporting at this enterprise – the Cash Flow

Statement. This will allow timely detection of discrepancies between actual and planned indicators, as well as information on each of the areas of cash receipts and expenditures regarding the percentage of their plan implementation. The basis of cash flow management is the availability of reliable and timely accounting information generated on the basis of accounting, management and financial accounting. This information is very diverse: cash flows in the company's accounts and cash desks, accounts receivable and payable, tax budgets, loan disbursement and repayment plans, interest payments, future procurement budgets, etc. The same information comes from different sources, so its collection and systematization must be approached with great care, as delays and errors in the provision of information can have serious consequences for the enterprise (Melnyk, 2017).

Some managers adhere to old and traditional methods of cash flow management, and therefore there is an average level of application of modern information technologies in the processes of cash flow management, which also affects the quality and timeliness of obtaining the necessary information on the state of the enterprise's cash flows. Due to the crisis situation, many enterprises do not always manage to adhere to the cash flow plan and comply with the proportions of cash distribution for their activities (Buryak & Demyanenko, 2019). To stay ahead of competitors and have a profitable business, the company's management needs to make informed management decisions, which is almost impossible without an effective cash flow management system.

Cash flow management at modern enterprises is one of the key components of financial management and business success. Research in this area is of great importance for enterprises, as it allows them to develop effective strategies and tools for cash flow management that help to increase financial stability and competitiveness. Ukrainian and foreign scholars have made a significant contribution to this area of research. One of the important contributions to the study of cash flow management is the work of C.B. Shubina & M.Yu. Avakyan (2014), who examined in detail the directions of improvement of cash flow management systems at Ukrainian enterprises. They identified the main shortcomings and proposed optimization of the cash flow management system as one of the key elements of assessing the financial condition of an enterprise. O. Guseva and colleagues (2021) developed a model of competitive advantage based on maximizing net discounted cash flow. They focused on complementary cash flow management, which involves a balanced distribution of the company's cash flows, which contributes to the achievement of competitive advantage. I. Khoma and O. Kostiuk-Pukaliak (2019) devoted their work to the study of new methods of analysing cash flows at enterprises and assessing the efficiency of enterprises, not limited to profit, but using the concept of free cash flow. This is suitable for a more accurate analysis of the financial condition and investment attractiveness of enterprises. Scholars such as L.O. Shkvarchuk & R.A. Slav'yuk (2017) and Z. Fakhroni *et al.* (2018) also expressed the importance of cash flow in assessing the

investment attractiveness of enterprises. They emphasized that free cash flow is a key indicator for determining the ability of an enterprise to attract investment. N. Poliukhovych *et al.* (2022) identified maximizing the amount of consolidated cash flow from operating and financing activities as one of the conditions for enterprise development. This emphasizes the importance of increasing cash flow for the stable operation and development of enterprises. Studies that focus on the importance of cash flow management in certain countries are also of great importance. H. Beladi *et al.* (2021), M. Kamel Al Zobi & O. Hel Al-Dhaimesh (2021), A. Rahman & R. Bahadur Sharma (2020), T. Alshammari (2020), H. Dang Ngoc *et al.* (2020), T. Kliestik *et al.* (2020), study the peculiarities of cash flow management in different countries and develop recommendations for enterprises operating in these market conditions. In summary, research in the field of cash flow management is extremely important for the development of enterprises and the stability of their financial activities. Scholars from both Ukraine and other countries are actively contributing to the improvement of cash flow management practices and the development of new methods for analysing and assessing the financial attractiveness of enterprises.

Many scientists and economists study the impact of cash flows on the activities of an enterprise, but there is a significant lack of separate comprehensive studies on the management of enterprise cash flows that could expand the boundaries of conventional analysis, could formulate appropriate approaches to ensuring their management, could offer specific ways and effective measures to improve the efficiency of enterprise cash flow management. It is important to note that inefficient cash flow management can occur even if a company is officially profitable. This is related to the problem of profitable but illiquid enterprises that may be on the verge of bankruptcy. The above measures can become effective recommendations for improving the efficiency of cash flow management not only for the analysed enterprise PJSC Odesa Cognac Factory, but also for similar enterprises that seek to improve the efficiency of their cash flow management, as they are universal in nature.

Conclusions

An appropriate assessment of the efficiency of managing the available cash flows of a particular enterprise becomes the initial information base for making further informed management decisions, i.e. forecasting cash flows for the future period. Therefore, the analysis of cash flow efficiency, which reflects the reasons for changes in the liquidity and financial stability of the enterprise, should be carried out in the overall financial analysis and should become a key component of this analysis of the enterprise's activities. Valid, complete, and reliable information on cash flows should contribute to improving the quality of management decisions, which will directly affect the future financial position of the company.

To ensure effective management of the overall cash flow and financial activities of an enterprise, the system of

calculating the cash flow indicator should be used as an indicator to measure financial and payment stability, and cash flow planning and management should be used as integral components of the process of managing the overall activities of an enterprise to achieve financial stability and solvency. In order to successfully solve the problem of inefficient cash flow management, which takes place at the enterprise of PJSC "Odesa Cognac Factory", as evidenced by the analysis, in particular: unacceptable values of cash flow efficiency ratios (0.16), net cash flow sufficiency (0.003) and net cash flow profitability (-14.9) over the past four years, as well as imbalance of cash flows, it is necessary to implement certain measures regarding the system of accounting, analysis, planning, and control of cash flows. Planning and optimization of economic activity of the entire enterprise, especially its cash flows, will significantly increase the efficiency of the enterprise.

The scientific novelty of this study is that the analysis of cash flow management on the example of the enterprise PJSC "Odesa Cognac Factory" provided an opportunity to identify the key areas that need to be addressed by the

management of companies to improve cash flow management in modern conditions, since the areas discussed in the article are universal and can be used as recommendations to improve the efficiency of cash flow management of many companies, which will positively affect their future activities. Studying the effectiveness of cash flow management remains an urgent need for enterprise management due to the important role they play in ensuring its effective functioning, and the main role of cash flow management is to ensure their balance by type, amount, time interval and other essential characteristics. Further research on the relationship between the quality of enterprise cash flow management and its value, which in turn is closely related to the level of investment attractiveness of the enterprise, may become promising areas within this issue.

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Conflict of Interest

None.

References

- [1] Azarenkova, G., Miroshnyk, O., & Kiselyova, O. (2022) Justification of parameters of optimization of cash flows of the enterprise. *Financial and Credit Systems: Development Prospects*, 2(5), 14-25. doi: 10.26565/2786-4995-2022-2-02.
- [2] Alshammari, T. (2020). Cash level and corporate performance: Evidence from the Gulf Cooperation Council countries. *Investment Management and Financial Innovations*, 17(4), 14-24. doi: 10.21511/imfi.17(4).2020.02.
- [3] Buryak, A.V., & Demyanenko, I.V. (2019). *Cash flow management: A segment of the financial policy of agricultural enterprises*. *Economic Forum*, 1(4), 103-108.
- [4] Beladi, H., Deng, J., & Hu, M. (2021). Cash flow uncertainty, financial constraints and R&D investment. *International Review of Financial Analysis*, 76, article number 101785. doi:10.1016/j.irfa.2021.101785.
- [5] Dang Ngoc, H., Vu Thi Thuy, V., & Nguyen Duy, H. (2020). The sensitivity of cash flows to cash holdings: Case studies at Vietnamese enterprises. *Investment Management and Financial Innovations*, 17(1), 266-276. doi: 10.21511/imfi.17(1).2020.23.
- [6] Dorosh, O.I., & Plish, I.V. (2021). *Planning of cash flows at the enterprise*. *Management and Entrepreneurship in Ukraine: Stages of Formation and Development Problems*, 2(6), 21-28.
- [7] Fakhroni, Z., Ghozali, I., Harto, P., & Nur Afri Yuyetta, E. (2018). Free cash flow, investment inefficiency, and earnings management: Evidence from manufacturing firms listed on the Indonesia Stock Exchange. *Investment Management and Financial Innovations*, 15(1), 299-310. doi: 10.21511/imfi.15(1).2018.25.
- [8] Financial reporting of PJSC "Odesa brandy plant". (n.d.). Retrieved from <http://doc.shustov.com/>.
- [9] Guseva, O., Legominova, S., Dymenko, R., Voskoboyeva, O., & Romaschenko, O. (2021). *A methodological approach to the management of competitive advantages based on the balance of cash flows*. Retrieved from <https://fkd.net.ua/index.php/fkd/article/view/3423>.
- [10] Iorgachova, M.I. (2018). Problems of corporate governance in Ukraine. *Efficient Economy*, 11, 1-8. doi: 10.32702/2307-2105-2018.11.50.
- [11] Krylova, O.V. (2019). Money flows in the system of support of the company's payment capacity. *Economy and State*, 7, 30-33. doi: 10.32702/2306-6806.2019.7.30.
- [12] Kamel Al Zobi, M., & Hel Al-Dhaimesh, O. (2021). The impact of cash flow statement components on stock volatility: Evidence from Qatar. *Investment Management and Financial Innovations*, 18(2), 365-373. doi: 10.21511/imfi.18(2).2021.29.
- [13] Khoma, I., & Kostyuk-Pukaliak, O. (2019). *Improving the tools for evaluating cash flows of e-commerce enterprises*. Retrieved from <https://fkd.net.ua/index.php/fkd/article/view/1959>.
- [14] Kliestik, T., Nica, E., Suler, P., & Valaskova, K. (2020). Innovations in company earnings management: The case of the Czech Republic and Slovakia. *Marketing and Innovation Management*, 3, 332-345. doi: 10.21272/mmi.2020.3-24.
- [15] Malikov, V.V. (2020). *Practical recommendations for managing cash flows of the enterprise*. *Business Inform*, 5, 370-374.
- [16] Mulyk, T. O. (2022). Methodical approaches to the analysis of cash flows of the enterprise. *Economy and Society*, 39. doi: 10.32782/2524-0072/2022-39-47.

- [17] Melnychuk, G.S. (2020). Theoretical aspects of the analysis of monetary assets of the enterprise. *Collection of Scientific Works of the State Fiscal Service University of Ukraine*, 2, 222-236. doi: 10.33244/2617-5940.2.2018.222-236.
- [18] Melnyk, M.I. (2017). Innovative attractiveness of Ukraine based on the Global Innovation Index. *Economic Bulletin of the Zaporizhzhya State Engineering Academy*, 4(10), 123-128.
- [19] Oliynyk, O.O. (2021). Cash and financial flows in the financial management system of enterprises. *Investments: Practice and Experience*, 13-14, 32-37. doi: 10.32702/23066814.2021.13-14.32.
- [20] Piskuleva, I.V., & Mavrina, M.I. (2022). Methodological approaches to the management of monetary resources: Modern aspect. *Efficient Economy*, 1. doi: 10.32702/2307-2105-2022.1.88.
- [21] Poliukhovych, N., Raicheva, L., & Ivanov A. (2022). Mathematical modeling of risk assessment of enterprise management. *Baltic Journal of Economic Studies*, 8(3), 166-173. doi: 10.30525/2256-0742/2022-8-3-166-173.
- [22] Rahman, A., & Bahadur Sharma, R. (2020). Cash flows and financial performance in the industrial sector of Saudi Arabia: With special reference to insurance and manufacturing sectors. *Investment Management and Financial Innovations*, 17(4), 76-84. doi: 10.21511/imfi.17(4).2020.07.
- [23] Shkvarchuk, L.O., & Slav'yuk, R.A. (2017). Analysis of cash flows in the system for assessing the investment attractiveness of enterprises. *Financial and Credit Activity Problems of Theory and Practice*, 1(22), 158-171. doi: 10.18371/fcaptp.v1i22.109943.
- [24] Skryl, V.V., & Stupenko, K.Yu. (2018). *Planning cash flows of the enterprise*. Retrieved from <http://www.economy.nayka.com.ua/?op=1&z=6737>.
- [25] Spilnyk, I., & Zagorodna, O. (2017). Cash flows of the enterprise: A complex analysis based on financial reporting data. *International Scientific Journal*, 1-2, 67-85.
- [26] Shubina, C.B., & Avakyan, M.Yu. (2014). Directions of enterprise cash flow management: Theoretical aspects. *Financial and Credit Activity Problems of Theory and Practice*, 2(5), 52-55.
- [27] Shchepina, T.G., & Titarenko, A.D. (2021). Comprehensive analysis of cash flows of the Antonov state enterprise. *Electronic Scientific Publication on Economic Sciences "Modern Economics"*, 26, 178-184. doi: 10.31521/modecon.V26(2021)-27.
- [28] Vasylychak, S., Shterna, T., Soloviy, S., Vivcharuk, O., & Kondel, Ie. (2023). Ukrainian agricultural labour potential management modelling in the context of European integration. *Scientific Horizons*, 26(12), 146-157. doi: 10.48077/scihor12.2023.146.

Напрями підвищення ефективності управління грошовими потоками підприємства

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Анотація. Проблема управління грошовими потоками підприємства є актуальною, оскільки вдале управління цими ресурсами є запорукою фінансової безпеки та стабільності будь-якого суб'єкта господарювання. Метою дослідження було виявлення універсальних рекомендацій щодо покращення управління грошовими потоками підприємства завдяки узагальненню теоретичних аспектів управління грошовими потоками та проведенні аналізу щодо стану грошових потоків ПрАТ «Одеський коньячний завод». При проведенні дослідження були використані методи: систематизації та узагальнення (досліджено теоретичні аспекти та узагальнено існуючі погляди науковців щодо сутності та управління грошовими потоками), факторний аналіз (виявлено ключові фінансові чинники впливу на процес управління грошовими потоками підприємства), коефіцієнтний аналіз (проведено аналіз ефективності управління грошовими потоками підприємства. На прикладі діючого підприємства ПрАТ «Одеський коньячний завод» проаналізовано динаміку змін ключових складових управління грошовими потоками та виявлені наявні прогалини щодо управління ними. Проведений аналіз дозволив виявити можливі напрями щодо підвищення ефективності управління грошовими потоками підприємства та надати певні рекомендації, у результаті впровадження яких підприємство матиме позитивний вплив на здійснення подальшої своєї діяльності, а саме: зосередження уваги на оптимізації наявних грошових потоків та їх збалансуванні; вивчення закономірності їх руху на підприємстві завдяки розрахунку показників ліквідності та платоспроможності; розгляд можливості запровадження використання на підприємстві бюджетування та фінансового моделювання, як додаткових інструментів управління грошовими потоками; створення на підприємстві незалежного відділу контролю за рухом наявних грошових потоків; використання достовірної та своєчасної облікової інформації щодо руху грошових потоків при прийнятті певних управлінських рішень завдяки підвищенню рівня застосування сучасних інформаційних технологій. Практичною цінністю дослідження є універсальний характер наданих рекомендацій щодо впровадження заходів з підвищення ефективності управління грошовими потоками, оскільки дані рекомендації можуть бути використанні також іншими аналогічними підприємствами

Ключові слова: чинники впливу; грошові кошти; надходження та витрати; збалансованість; синхронність; рекомендації

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A study of agro-economic development and its impact on socio-economic inequality in Ukraine

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Abstract. In today's world, the problem of inequality is gaining global significance, and numerous international institutions set among their main tasks the fight against its manifestations – economic, social, etc. The study of economic inequality during martial law is extremely relevant, as it primarily negatively affects people's lives and well-being, provokes crises and additional social tensions, and, as a result, destabilizes the state system and the national economy, which are already in a state of crisis due to military operations. The purpose of this paper is to analyse the causes of social and financial stratification of Ukrainian society in the context of agro-economic development. The dynamics of salary in Ukraine, in particular, in the agricultural sector, was studied using the method of statistical analysis, and the index of general economic stratification was calculated using the Gini coefficient method. Statistical data on the development of the agricultural land market was analysed, starting from the end of the moratorium in July 2021 and until June 2023. As a result, the current key indicators of the land market in Ukraine, and information on salary in various sectors of the economy in the period from 2014 to 2022 were obtained, and the incomes of agricultural employees were analysed, which turned out to be below

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average. For a more objective assessment, statistics on the largest agricultural countries of the European Union were used and compared with their inequality indicators. The calculation of the Gini coefficient showed a 10% increase in the inequality of income distribution of Ukrainian households between 2014 and 2022, but it was still lower than the current indicators of such European countries as Germany, Sweden, and Poland. The practical significance of the work lies in the development of recommendations for reducing the gap between rich and poor in Ukraine, in particular in the agricultural sector, which can be used by the relevant authorities to redistribute the agricultural market and optimize tax legislation

Keywords: social injustice; agricultural economics; stratification of society; stratification; global hunger

Introduction

Economic inequality, in addition to the obvious social negative effect, has another dimension – the statistical one. In a stratified society, metadata does not fulfil its function and does not give a real picture – because average economic indicators may look acceptable from a mathematical point of view, which makes it much more difficult to diagnose such an economy. Since Ukraine is a recognized producer of agricultural products and the country's gross domestic product (GDP) depends to a large extent on agro-economic indicators, it is important to identify and analyse how the agro-industrial complex (AIC) affects the gap between wealth and poverty in Ukraine. Scholars have repeatedly addressed this pressing issue to find ways out of it. For example, A. Putytskyi (2022) generally rejected the use of the term “socio-economic inequality”, since economic inequality is only one component of social inequality, including in the agro-industrial sector. In his opinion, economic stratification is a rather dynamic process of redistribution within society, in which citizens migrate between strata (layers), emphasizing the two-sidedness and different intensity of this migration.

According to Y. Erdevdi (2020), economic inequality as a phenomenon has penetrated so deeply into all spheres of human life and has reached such relative values that the problem can no longer be solved at the level of national governments, but requires the involvement of higher institutions in the form of influential international organizations. According to the author, globalization is the reason for the tectonic shifts in society that have led to income polarization becoming a global trend in 2000-2020, and now it is necessary to develop an economically sound mechanism at the level of supranational structures to overcome extreme wealth, which should lead to the overcoming of extreme poverty. The problem of the world's agricultural deficit and the prospect of global hunger makes it necessary to speed up the adoption of such a decision.

What exactly does inequality in society consist of, was studied by V. Koibichuk & S. Drozd (2022) have studied the causes of inequality in society and concluded that the key factors include labour market systems, access to education, environmental protection, agricultural technologies, and healthcare facilities. Having formed a feature space of determinants that determine human inequality indicators, the authors developed a statistically significant econometric regression model of the degree of influence and identified opportunities to reduce gaps in the values of stratification

indicators. The fact that food is still the most important item of household expenditure in Ukraine indicates the low standard of living of the majority of the population, and the impact of agricultural products on these processes cannot be overestimated. O. Fomina & N. Hoholieva (2021) studied in detail the economic behaviour of households shaped by the current standard of living of citizens and, using the methods of economic and mathematical statistics, investigated the division of society by the level of average per capita equivalent income. As a result, the Lorenz curve confirmed the low level of population differentiation in Ukraine and the large number of poor households.

However, if analysing economic inequality purely by income, this indicator for Ukraine is low compared to most European countries. At the same time, the distribution of property, primarily privatized agricultural enterprises, between different stratification groups is extremely uneven, and this factor has a significant impact on the statistics. O. Cherechin *et al.* (2023), having studied this phenomenon, proved the need to change this imbalance to strengthen the social development of the state. The full-scale military invasion of Ukraine in February 2022 had a significant impact on all economic indicators, including the income stratification of the population. V. Koziuk & A. Kremez (2023), considering the issue in the context of differentiation of income distribution of Ukrainian citizens during the war period, stated that the economy lost not only human capital but also a large amount of agricultural land. One of the tools to remedy the critical situation is to revise the principles of burdening business, including farming, which would allow the state to have more working capital to respond quickly to new economic challenges.

As confirmed by numerous colleagues, the situation with economic inequality in Ukraine is extremely complex. The purpose of this paper is to analyse the current agro-economic situation in the country and to formulate our own proposals for overcoming the crisis and reducing the gap between the rich and the poor.

Materials and Methods

Using the method of statistical analysis, several key indicators of the development of Ukraine's economy as a whole and the agricultural sector were selected from the State Statistics Service of Ukraine (Average monthly salary..., n.d.), in particular, for 2014-2022. At the same time, the index of economic stratification was calculated, and the

correlation of these indicators was analysed using the method of pattern discovery. In particular, the following indicators of agricultural land market development in Ukraine were used, provided by the Ukrainian State Service of Ukraine for Geodesy, Cartography, and Cadastre (The official of the State Service..., n.d.), such as the number of registered agricultural lands in the state land cadastre, the average normative monetary value of arable land, the weighted average purchase and sale price of an agricultural land plot, the average number of purchase and sale transactions per day in 2023, the average size of a land plot of a purchase and sale transaction, the number of concluded purchase and sale transactions, and the area of registered purchase and sale transactions.

As for the area of land sales and purchase transactions and the weighted average price per hectare, a special visual chart was created to demonstrate the correlation between these factors in 2021-2023 based on data obtained from the Analytical Report (Nivevskyi *et al.*, 2023) and the Agropolit portal (Two years of the land..., 2023). Also, to assess the contribution of agriculture to the average monthly salary of full-time employees, this indicator was considered in comparison with the average salary in all industries in the period from 2014 to 2022. In addition, the comparison method was used to obtain the amount of arable land among such European Union leaders in this area as Poland, Sweden, and Germany, and compared with the social and economic stratification of these countries. The index of general economic stratification was calculated by calculating the Gini coefficient, which is the ratio of the area of the figure formed by the Cauchy distribution and the line of equality to the area of the triangle formed by the line of equality and the axes. In other words, if two figures are identical, the Gini coefficient is zero, and if they are completely unequal, it is one.

The calculation is performed according to the formula:

$$G = \frac{\sum_{i=1}^n \sum_{j=1}^n |y_i - y_j|}{2n^2\bar{y}}, \quad (1)$$

where G is the Gini coefficient; n – number of households; y_i – the share of income of households of the category in the total income; \bar{y} is the average arithmetic share of household incomes.

The use of this particular method in this paper is explained by a number of advantages of the Gini coefficient, such as the possibility of correct comparison of inequality indicators in regions with different populations, the ability to track the dynamics of uneven distribution of an indicator (i.e., income) in the aggregate at different stages, as well as anonymity, i.e., the exclusion of personal data of specific households or individuals from the calculations. The analysis of the correlation of these indicators, obtained from The World Bank portal (Gini index, n.d.), provided an answer to the degree of economic inequality in some agrarian countries of Europe and Ukraine, as well as the impact of the agro-industrial complex on it.

Results

Between 1 July 2021 and 31 December 2023, the turnover of agricultural land is allowed exclusively between Ukrainian citizens, and during this period, the alienation of privately owned agricultural land is allowed for no more than 100 hectares in one hand. Only from 1 January 2024, a Ukrainian citizen will be entitled to own agricultural land plots with a total area of up to 10,000 hectares (Law of Ukraine No. 552-IX..., 2020). Even though a little more than six months have passed since the adoption of the Law and the outbreak of full-scale war, the industry has started working in a new format and has a number of achievements, as summarized in Table 1.

Table 1. Key indicators of the agricultural land market in Ukraine as of June 2023

All lands are registered in the state land cadastre	43.6 million ha
Agricultural lands are registered in the state land cadastre	32.7 million ha
The average normative monetary value of arable land	27 520 UAH/ha
The average weighted price of the purchase and sale of the plot of agricultural land of destination	35 367 UAH/ha
The average number of purchase and sale transactions per day in June 2023.	213
The average size of the land plot of the sale agreement	2.21 ha
The number of concluded purchase and sale agreements	158 761
Area of registered purchase and sale agreements	351 251 ha

Source: developed by the authors based on the data of O. Nivevskyi *et al.* (2023)

In 2022, due to several reasons related to the war – the occupation of parts of the territories of Zaporizhzhia, Kharkiv, and Kherson regions, the outflow of the working population abroad, mobilization into the army, etc. – there was a significant decline in economic performance, with Ukraine's GDP falling by almost 30% (Tarasovskiy, 2023).

However, the land market in Ukraine almost never stopped operating, as evidenced by the statistics on access to land, both in terms of the number of transactions and the volume of land. Thus, according to the specialized agricultural portal Agropolit (Two years of the land..., 2023), 23 178 sale and purchase agreements were concluded in 2022, and

14 605 in 5 months of 2023. Thus, in less than half a year, 63% of the previous year's figures were achieved. More

complete and visual data on agricultural land sales are shown in Figure 1.

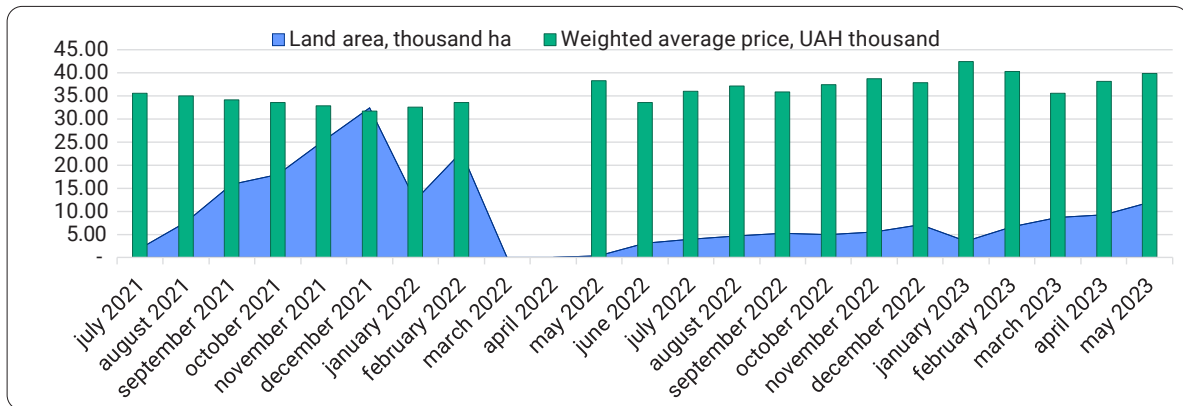


Figure 1. Dynamics of agricultural land sales in Ukraine in 2021-2023

Source: developed by the authors based on data from Two years of the land market in Ukraine: Achievements and failures, and how war has changed it (2023)

As can be seen from the Figure, after the market resumed in May 2022, the volume of land sold increased almost linearly, with the weighted average price per hectare fluctuating within roughly the same range throughout the entire period of observation. In terms of land use, according to the State Geocadastre (The official of the State Service ..., n.d.), sale and purchase transactions in 2023 were mainly for commodity land (47% of transactions) and land for private farming (45% of transactions). Since all commercial land, as well as a significant part of private farming land, was under a moratorium until July 2021, due to the larger average land plot size, commercial land dominates (66% of all land in circulation), while land for private farming accounts for only 23% of the total land area.

Land concentration is also an important parameter in assessing the objectivity and transparency of the land market. According to the legislation, starting from 2024, the restriction on the sale of land to one owner will be increased, but still will not exceed 10 thousand hectares (Two years of the land..., 2023). It is worth noting that the Law contains a safeguard that will prevent even banks from becoming agriholdings, as they will have the right to take away land plots pledged to them. To prevent banks from accumulating a huge amount of agricultural land in their assets, the law requires financial institutions to dispose of such land plots at land auctions within two years of acquiring ownership. In general, one of the key reasons for economic inequality is the uneven and inefficient distribution of income, which leads to the polarization of society, with economic "poles" forming between which there are structural disproportions in the quality of life. In this case, one conditional pole is occupied by poor people who are deprived of investment capital, real estate and, most importantly, the prospects of obtaining all of this. At the other pole is a much smaller stratum of oligarchs, who own virtually the entire industrial economic potential of the country.

The agricultural sector has a significant impact on economic inequality and, along with the growth of commodity production in the agricultural sector, the inequality of incomes is decreasing, but these indicators are unevenly distributed in the sector. In particular, the increase in grain production, driven by the introduction of technology, lower transport costs, and liberalized bank lending policies, has contributed to economic growth in Europe and, consequently, to poverty reduction (ITU & FAO, 2020). Technology is becoming an important factor in the development of agribusiness in Europe and Central Asia, which is taking place in the context of a growing demand for accessible and reliable information. Increasing agricultural revenues allow landowners to invest in modern digital technologies, which further increases business margins. However, the relationship between agricultural growth and income inequality is complex and depends on specific country and firm conditions. The conservatism of agricultural markets in developing countries, including limited redistribution of labour, can lead to an uneven distribution of poverty, especially in rural areas. Changes in procurement policies, such as quotas or export taxes, can quickly affect income inequality through changes in prices and salary. Reducing trade barriers in agriculture can increase market failures and demand asymmetries, leading to lower incomes and a widening gap between rich and poor.

In order to minimize these negative effects, another UN agency dealing with industrial development aims to promote industrial and agricultural development and accelerated industrialization in developing countries by mobilizing national and international resources. According to the latest joint report of UNIDO and the European Union (2021), many projects are dedicated to strengthening the agro-industrial complex of European countries and their sustainable development. In the long term, the development of agricultural technologies, productivity, intra-industry competition, and infrastructure development also

play a role in determining changes in income, poverty, and inequality, but given the indirect relationship between these processes, the level of such changes is difficult to predict. However, it is already clear that expanding the range of agricultural production and increasing the volume of agricultural products will provide consumers with access to cheaper and more diverse food, which will have a positive impact on their lives and health, and ultimately lead to better economic opportunities for the poor.

Overall, the obstacles to a more equitable distribution of agricultural trade revenues include ineffective policies to

address underlying inequalities and structural problems. These include poorly designed or underfunded agricultural development programmes; gender discrimination or marginalization of certain groups (e.g. migrant workers) in accessing productive resources; persistent barriers faced by the poor, women, and youth in accessing credit, knowledge, and markets; and excessive managerial influence over the marketing part of agricultural value chains. Another indicator of the relationship between the agro-industrial complex and the level of household consumption opportunities is the level of average salary in the dynamics (Table 2).

Table 2. Average monthly salary of full-time employees by type of economic activity in Ukraine by year, hryvnias

Activity	2014	2015	2016	2017	2018	2019	2020	2021	2022
Agriculture	2 476	3 140	3 916	5 761	7 166	8 738	9 734	11 733	12 243
Industry	3 988	4 789	5 902	7 631	9 633	11 788	12 759	14 902	15 176
Construction	2 860	3 551	4 731	6 251	7 845	9 356	9 832	11 289	9 781
Trade	3 439	4 692	5 808	7 631	9 404	10 795	11 286	13 488	15 103
Logistics	3 768	4 653	5 810	7 688	9 860	11 704	11 951	13 837	13 731
HoReCa	2 261	2 786	3 505	4 988	5 875	6 730	6 026	8 543	9 367
Communication sphere	5 176	7 111	9 530	12 018	14 276	17 543	19 888	25 530	30 829
Financial activity	7 020	8 603	10 227	12 865	16 161	19 132	20 379	23 975	27 986
Real estate	3 090	3 659	4 804	5 947	7 329	8 626	8 981	11 142	11 560
Research activities	5 290	6 736	8 060	10 039	12 144	14 550	16 613	19 369	20 497
Admin services	2 601	3 114	3 995	5 578	7 228	8 700	9 878	11 186	12 291
State defence	3 817	4 381	5 953	9 372	12 698	14 785	16 443	19 048	20 764
Education	2 745	3 132	3 769	5 857	7 041	8 135	9 271	11 817	11 999
Health care	2 463	2 853	3 435	5 023	5 898	7 087	8 995	11 825	14 002
Art and sport	3 626	4 134	4 844	6 608	7 612	8 659	9 624	12 508	11 567
Average indicator	3 641	4 489	5 619	7 550	9 345	11 089	12 111	14 679	15 793

Source: developed by the authors based on data of Average monthly salary of full-time employees by types of economic activity

To understand the correlation of the level of salary in the agro-economic sector and the national economy as a

whole, it is necessary to compare these two indicators in dynamics, which was visualized in Figure 2.

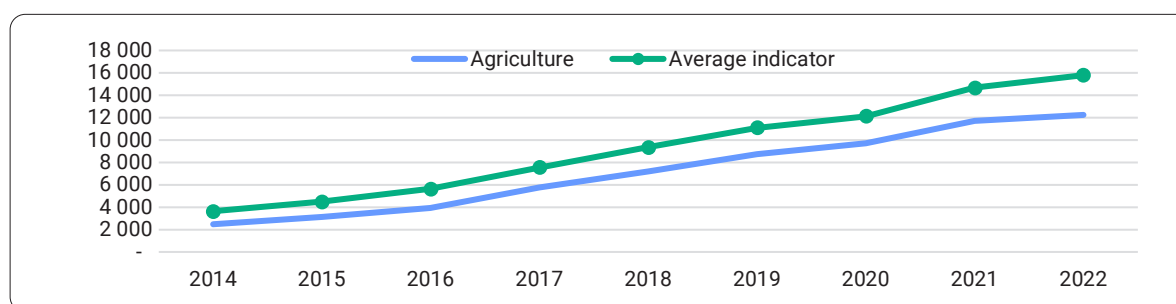


Figure 2. The average level of salary in Ukraine in relation to salary in the agricultural sector

Source: developed by the authors based on data of Average monthly salary of full-time employees by types of economic activity (n.d.)

According to the chart, the average salary level in Ukrainian agriculture over the previous nine years was lower than the multi-sectoral average. This leads to the conclusion that for ordinary agribusiness workers, belonging to the agro-industrial complex does not provide an

opportunity to receive a decent salary, but rather only deepens economic inequality in income. Moreover, the upward trend in salary in 2021-2022, which is noticeable for the national average, is much lower for agribusiness employees. It is also important to obtain data on economic

inequality in some European countries to track the relationship between these indicators. The most important generally recognized indicator of financial stratification of society is the Gini coefficient, which demonstrates the

inequality of household income distribution and takes a value between 0 (absolute equality) and 1 (absolute inequality). For Ukraine, this coefficient has a rather non-linear dynamics, as shown in Figure 3.

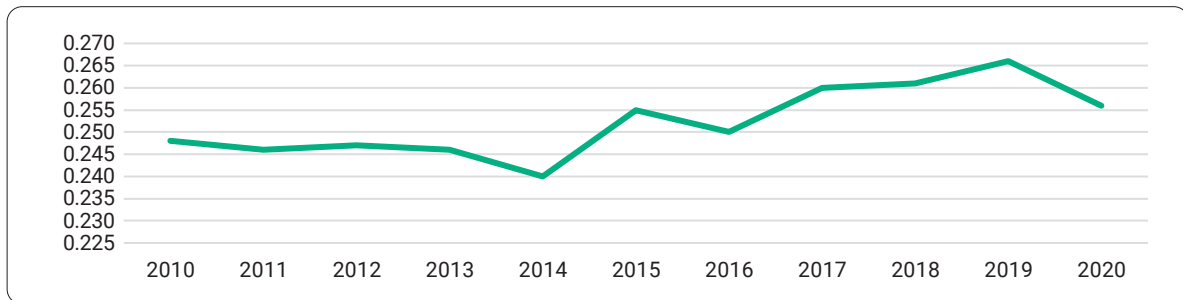


Figure 3. Gini coefficient of household income distribution in Ukraine

Source: developed by authors based on data of Gini index (n.d.)

As can be seen from the graph, from 2010 to 2014, the economic imbalance of society had a clearly visible downward trend, but in 2014 the trend reversed and in just one year, inequality indicators “played back” all the progress of the previous four years. Between 2014 and 2019, the Gini coefficient increased by 10%, which is most likely due to foreign aggression and the occupation of part of the country’s territory, which triggered additional economic and social problems in Ukrainian society.

To understand the general trend of economic inequality in Europe and to compare this data with Ukrainian indicators, a similar analysis was conducted for three European Union countries – Poland, as the geographically and historically the closest European country to Ukraine, Germany, as the continent’s economic leader, and Sweden, as the country stereotypically perceived as the most balanced in terms of social policy. The Gini coefficient for Poland is shown in Figure 4.

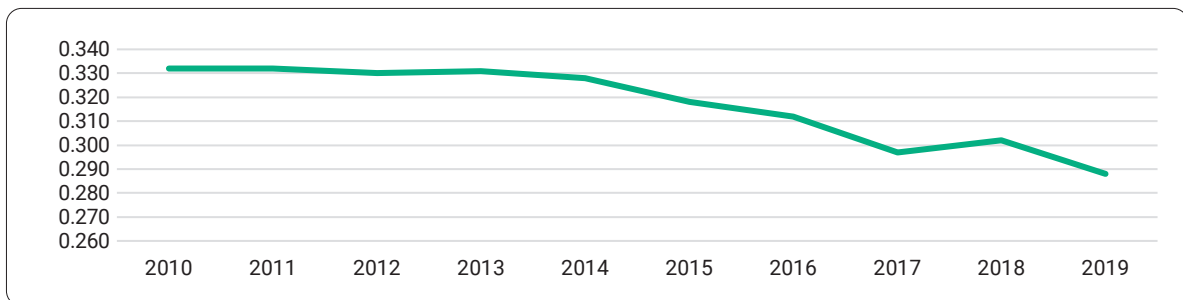


Figure 4. Gini coefficient of household income distribution in Poland

Source: developed by the authors based on data of Gini index (n.d.)

Given the trend of the graph above, it can be argued that economic inequality in Poland is significantly decreasing almost every year. However, even after a continuous

decline for almost a decade, Poland’s Gini coefficient in 2019 was still higher than Ukraine’s – 0.288 versus 0.265. The Gini coefficient for Germany is shown in Figure 5.

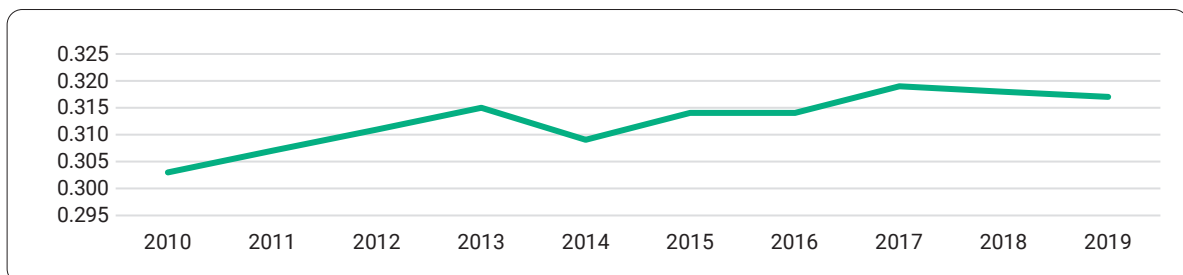


Figure 5. Gini coefficient of household income distribution in Germany

Source: developed by the authors based on data of Gini index (n.d.)

Economic inequality in Germany began to grow rapidly in 2010, likely due to liberalized migration policies and a significant influx of unskilled workers from less economically developed countries in Europe. The situation stabilized somewhat and formed a new balance point in 2013-2017, after which the fluctuations in the index became insignificant. It is important to note again that the index of

economic stratification in Germany is higher than in Ukraine, despite Ukraine's significant economic lag. Finally, for a comprehensive assessment of European inequality indicators, it is necessary to analyse the indicators of Sweden, which is a true welfare state by many measures, with an exceptional attitude to protecting all segments of the population. The Gini coefficient for Sweden is shown in Figure 6.

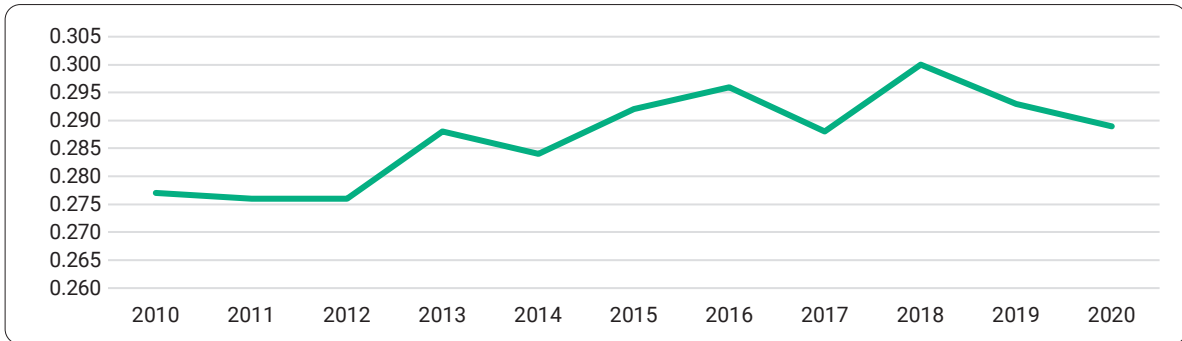


Figure 6. Gini coefficient of household income distribution in Sweden

Source: developed by the authors based on data of Gini index (n.d.)

Despite the rather non-linear shape of the Gini coefficient graph for Sweden, there is a fairly steady upward trend in this negative indicator. This may also be due to the rather liberal legislation on the admission of migrants and refugees who are willing to work for low salary by Swedish standards. The drop in the inequality indicator in 2020 may be caused by the COVID-19 pandemic and the resulting

temporary shortage of staff in the labour market. Thus, despite the stereotypes of extremely high income inequality in Ukraine and, conversely, the social justice policies of Western and Northern Europe, the actual state of affairs is quite different and Ukraine's indicators are the lowest. A comparative graph of the Gini indices of the four countries studied is shown in Figure 7.

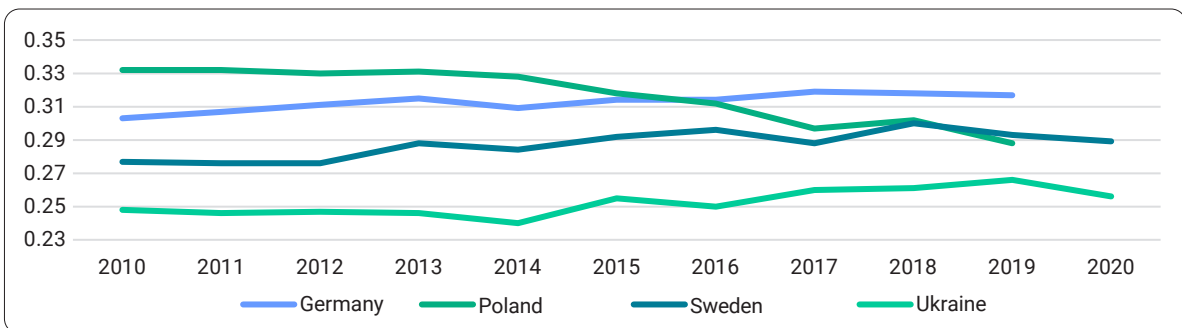


Figure 7. Comparison of the Gini coefficient

Source: developed by the authors based on data of Gini index (n.d.)

To summarize, Germany and Poland demonstrate higher inequality indicators than Ukraine. Thus, the stratification of Ukrainian society does not show signs of deep doom, but requires active action by civil society to normalize the situation and introduce a fair distribution of social benefits. Agriculture is different from most other businesses. Farmers' income is about 40% lower than non-agricultural income, despite the importance of food production (Korinets, 2023). In addition, agriculture is more dependent on weather and climate than many other industries. There is also an inflexible time lag between consumer demand and farmers' supply, meaning that growing more wheat or producing more milk cannot happen instantly.

A rational fiscal policy that reduces inequality by redistributing and better targeted expenditures to social security systems, education, and labour programmes that expand employment opportunities could address these contradictions. Such programmes include, in particular, the European Commission's Common Agricultural Policy Objectives (The common agricultural policy at a glance, n.d.), which outlines programmes to support incomes, public services and market-based measures to overcome difficult situations such as a sudden drop in demand until 2027.

Another proven lever of state influence is the active and prompt resolution of conflicts that inevitably arise after any reforms and the introduction of additional measures

to ensure an even distribution of income both within the country and in export-import relations. Greater access to education, information, and targeted programmes to promote geographical and sectoral mobility of workers is also essential, leading to greater independence for the most vulnerable labour groups. Such an approach would certainly help to harness the power of Ukraine's agricultural sector to achieve and sustain broad-based income growth, poverty reduction and greater equality.

If the current owners of agro-industrial holdings are not ready for positive changes and are not ready to increase the level of social justice for their staff, the state should intervene, ensuring, on the one hand, a fair redistribution of profits in this strategic sector through a system of social benefits, privileges and targeted assistance to agricultural employees, and, on the other hand, introducing such a mechanism of influence on agricultural oligarchs as progressive taxation. In some cases, it is also worth considering breaking up large, inert farms into smaller, more mobile, and open to innovation. However, the uniqueness of Ukraine at this point in history lies in the active hostilities in the southern and eastern regions and the permanent air threat throughout the country. Since numerous agricultural enterprises are concentrated in the South, structural reforms should be implemented after the victory in the demining of agricultural land.

Discussion

Analysing the results of this work, it is worth paying attention to the world experience of studying the issue of social and economic inequality, especially in the context of the impact of agroeconomics on these processes. For example, A. Györi & I. Kovách (2023) studied land reform and privatization of collective land in the context of the dismantling of the Hungarian socialist system and stated that the structure of land ownership and land use changed significantly after the fall of the communist regime in most countries of Central and Eastern Europe, which can be observed in Ukraine. After examining the statistical relationship between land ownership structure and economic, social and infrastructural characteristics of communities, the authors conclude that municipal land use structure is a significant measure of social and economic inequality and find a causal relationship between the level of community development and clusters of municipal land use structure.

A similar study of the impact of the agricultural sector on household income was also conducted by T.Q. Tran *et al.* (2023), but instead of the agricultural sector, which is common for Ukraine, they used data from peasant aquaculture, which is more typical for Vietnam. Using data from the Household Living Standards Survey, the relationship between aquaculture, family income, and economic inequality was investigated. Using a two-stage cluster analysis, the authors found that for almost half of the respondents, fishing and related crafts are literally their livelihood, which is certainly different from the Ukrainian reality, where subsistence farming is not on such a large scale.

The important link between agriculture and the welfare of workers in the sector was investigated by N. Kaiser & C.K. Barstow (2022), through the prism of rural transport infrastructure development. Since rural transport is a key driver of many sustainable development goals and a significant factor in the socio-economic benefits for rural populations around the world, improving and expanding rural transport infrastructure brings significant benefits to rural residents. Accordingly, the need for the state to be interested in increasing the income of ordinary agricultural workers is consistent with similar conclusions of this paper. A certain inertia of large farms, mentioned above, was also noticed by R. Balogh *et al.* (2021). The unwillingness of large agricultural enterprises to change gives a competitive advantage to smaller farms, in particular, the introduction of more advanced precision agriculture, which guarantees increased profits for the owner and a reduction in the economic and property gap in the industry.

The state support of small farms, on which the topic of economic inequality in agribusiness directly depends, is the focus of the work of O. Skydan *et al.* (2023). According to their findings, small farms dominate the European agricultural landscape, but their representatives, unlike large farms, are almost not represented in sectoral decision-making structures, which reduces the degree to which the needs of small businesses are considered in public agricultural policy and support measures. This lack of representation limits the contribution of small farms to national food security, as was also observed in the course of this study. The imbalance of tax legislation for small farmers, which exacerbates economic stratification of society, has also been studied by I.D. Puspasari (2020). After analysing data from various sources over five years, the author concluded that the current system of land taxation does not allow farmers to gain economic independence and improve the living standards of their households.

In some countries with multi-level governance systems, the scale of regulatory interventions by the state and the number of permits can be confusing for farmers. Duplication of regulatory functions in the agricultural sector can cause chaos in the operation of agricultural complexes and negatively affect their efficiency and profitability. Having studied the environmental regulation of agriculture in the Australian state system, E. Hamman *et al.* (2021) propose a comprehensive and flexible regulatory policy that rewards farmers for following the rules of sustainable development and managing natural capital wisely, leading to a reduction in inequality in the economy.

As mentioned earlier in this paper, the unjust and unprovoked full-scale military aggression against Ukraine that began in February 2022 has had a huge negative impact on global food security. M. Marson & D. Saccone (2023), studying the current consequences of the war for grain exports, state the objective prerequisites for the emergence of millions of newly malnourished people around the world due to the complication of maritime trade in the Black Sea in grain crops, especially wheat and corn. Moreover, the

reduction of crop areas caused by the hostilities also has a negative impact on the welfare of Ukrainians working in the agricultural sector, who are forced to lose their only income.

Regarding the conditions for recognizing economic inequality as fair, which were mentioned in this article, K.-S. Trump (2020) and T. Cherkashyna (2022) also investigated situations in which inequality promotes development. In particular, they find that rising economic inequality does not directly affect the perception of justice, but can reduce the perception of meritocracy. In some cases, economic inequality can affect subjective well-being through psychological processes such as competition for status and social distance. As noted by G.B. Willis *et al.* (2022), perceived inequality is not related to objective inequality for several reasons: first, societies with real social inequality are too separated both mentally and physically, which, accordingly, reduces the chance of contact with a member of the "other" stratum. Secondly, people are more affected by signs of economic inequality in their everyday lives than by abstract news from the media. And finally, thirdly, ideologues serving the upper strata in a truly stratified society correct the attitude of the lower strata to reality. The dynamics of Sweden's indicators in the context of economic inequality analysed in this paper also attracted the interest of G. Thernborn (2020), who conducted a comparative empirical review of the growth of inequality in this Scandinavian country since 1980 and, using sociological analysis, found the dependence of stratification processes on the change of political generations and the new ideological climate.

According to J.D. García-Castro *et al.* (2020), one of the most effective ways to reduce economic inequality is to reduce tolerance for inequality and increase support for economic redistribution. Instead of measuring the effects of abstract perceived inequality (e.g., measured at the national level), it is important to consider the perceived economic inequality of citizens in their daily lives. The results of the study emphasize the importance of the perception of such tangible inequality as an additional tool when considering the psychosocial consequences of economic stratification. Another study on the topic of economic inequality, which also confirmed the findings of this paper, was conducted by D. Goya-Tocchetto & B.K. Payne (2022). In particular, according to the authors, inequality can function as a social context that shapes people's expectations, needs, desires, and affiliation with certain groups. At the same time, it is important to understand that absolute equality is also unacceptable, and in most cases, it is more appropriate to speak of injustice rather than inequality.

Assuming that inequality affects individuals from two directions – objective and subjective – A. Schmalor & S.J. Heine (2022) have shown that understanding the effects of economic inequality will be deepened if considering not only the actual state of affairs, but also how people perceive

inequality. The authors also noticed changes in the subjects' assessment of their economic inequality after the influence and beliefs of the experimenters, which indicates the subjective factor of the concept of justice, which is also mentioned in the current work. Comparing the above results with those obtained in the course of the study, it is worth noting the international nature of the concept of economic inequality, as well as the common manifestations of this social factor in the context of the agrarian economy.

Conclusions

The aim of the study was to analyse the causes and consequences of economic inequality and to find ways to reduce the gap between rich and poor, and it revealed rather low salary in the industry, which are even lower than the average salary in the country, and a steady increase in economic stratification of the population during 2014-2020. However, the lifting of the moratorium on the sale of agricultural land in Ukraine in 2021 had a positive impact on the further development of the industry. Moreover, even the outbreak of a full-scale war could not stop these processes.

After analysing the performance of several leading EU agricultural countries, it was noted that despite the significant economic advantage of Poland, Germany, and Sweden over Ukraine, economic inequality in these countries, although trending downwards, still exceeds Ukrainian indicators. Another important conclusion is that, as the amount of arable land in the EU remained almost unchanged over the 10 years from 2010 to 2020, the success of a modern agricultural sector is correlated not with the area, but with the technologies used to use it. This is especially important in the context of the existing long-term programme to support European farmers, as mentioned above.

Overall, it has been proven that working with agricultural products requires targeted efforts to guarantee equal access and economic opportunities for women, youth, poor farmers, and other vulnerable groups. To mitigate the potentially negative impacts of increased competition from food imports, smallholder farmers need access to finance, resources, knowledge, and markets, as well as workable schemes to diversify their income sources, including off-farm activities. An additional measure to prevent further widening of economic inequality could be a government targeted programme to support small farmers to create a balance in the grain market, like the European one. The design and economic feasibility of such a programme could be the subject of a future study.

Acknowledgements

None.

Conflict of Interest

None.

References

- [1] Average monthly salary of full-time employees by types of economic activity. (n.d.). Retrieved from https://ukrstat.gov.ua/operativ/operativ2021/gdn/szpshp/arh_szp_ed_u.html.

- [2] Balogh, P., Bai, A., Czibere, I., Kovách, I., Fodor, L., Bujdos, Á., Sulyok, D., Gabnai, Z., & Birkner, Z. (2021). Economic and social barriers of precision farming in Hungary. *Agronomy*, 11(6), article number 1112. doi: [10.3390/agronomy11061112](https://doi.org/10.3390/agronomy11061112).
- [3] Cherechin, O., Komar, V., Borzov, O., Voievidka, I., & Borodin, Y. (2023). Key directions to overcome economic inequality for enhancing the social development of the state. *Scientific Notes of Lviv University of Business and Law*, 37, 431-436. doi: [10.5281/zenodo.8120785](https://doi.org/10.5281/zenodo.8120785).
- [4] Cherkashyna, T. (2022). Taxonomic analysis of income inequality in the EU countries. *Economics of Development*, 21(4), 8-18. doi: [10.57111/econ.21\(4\).2022.8-18](https://doi.org/10.57111/econ.21(4).2022.8-18).
- [5] Erdevdi, Y. (2020). Analysis of international organizations in overcoming inequality. *Young Scientist*, 4(80), 26-29. doi: [10.32839/2304-5809/2020-4-80-6](https://doi.org/10.32839/2304-5809/2020-4-80-6).
- [6] Fomina, O., & Hoholieva, N. (2021). Income inequality in Ukraine: Features of economic behavior of households. *Scientific Bulletin of KSU. Series "Economic Sciences"*, 42, 5-11. doi: [10.32999/ksu2307-8030/2021-42-1](https://doi.org/10.32999/ksu2307-8030/2021-42-1).
- [7] García-Castro, J.D., Rodríguez-Bailón, R., & Willis, G.B. (2020). Perceiving economic inequality in everyday life decreases tolerance to inequality. *Journal of Experimental Social Psychology*, 90, article number 104019. doi: [10.1016/j.jesp.2020.104019](https://doi.org/10.1016/j.jesp.2020.104019).
- [8] Gini index. (n.d.). Retrieved from <https://data.worldbank.org/indicator/SI.POV.GINI>.
- [9] Goya-Tocchetto, D., & Payne, B.K. (2022). How economic inequality shapes thought and action. *Journal of Consumer Psychology*, 32(1), 146-161. doi: [10.1002/jcpy.1277](https://doi.org/10.1002/jcpy.1277).
- [10] Györi, Á., & Kovách, I. (2023). The new dimension of social inequality: The agricultural land use structure and the development level of settlements. *Social Sciences*, 12(2), article number 88. doi: [10.3390/socsci12020088](https://doi.org/10.3390/socsci12020088).
- [11] Hamman, E., Deane, F., Kennedy, A., Huggins, A., & Nay, Z. (2021). Environmental regulation of agriculture in federal systems of government: The case of Australia. *Agronomy*, 11(8), article number 1478. doi: [10.3390/agronomy11081478](https://doi.org/10.3390/agronomy11081478).
- [12] ITU & FAO. (2020). *Status of digital agriculture in 18 countries of Europe and Central Asia*. Geneva: International Telecommunication Union & Food and Agriculture Organization.
- [13] Kaiser, N., & Barstow, C.K. (2022). Rural transportation infrastructure in low- and middle-income countries: A review of impacts, implications, and interventions. *Sustainability*, 14(4), article number 2149. doi: [10.3390/su14042149](https://doi.org/10.3390/su14042149).
- [14] Koibichuk, V., & Drozd, S. (2023). Intensification of economic growth in the context of reducing human inequality differentiation. *Black Sea Economic Studies*, 74, 240-248. doi: [10.32843/bses.74-36](https://doi.org/10.32843/bses.74-36).
- [15] Korinets R. (2023). *Rural development*. Kyiv: Germany-Ukraine agricultural policy dialogue.
- [16] Koziuk, V., & Kremez, A. (2023). Differentiation of income distribution in the population of Ukraine during the war and post-war period. *Innovation and Sustainability*, 1, 64-71. doi: [10.31649/ins.2023.1.64.71](https://doi.org/10.31649/ins.2023.1.64.71).
- [17] Law of Ukraine No. 552-IX "On Making Changes to Some Legislative Acts of Ukraine Regarding the Terms of Circulation of Agricultural Land". (2020, March). Retrieved from <https://zakon.rada.gov.ua/laws/show/552-20#Text>.
- [18] Marson, M., & Saccone, D. (2023). Fed with import and starved by war: Estimating the consequences of the Russia-Ukraine conflict on cereals trade and global hunger. *International Economics and Economic Policy*, 20, 413-423. doi: [10.1007/s10368-023-00564-x](https://doi.org/10.1007/s10368-023-00564-x).
- [19] Nivevskyi, O., Neyter, R., Yurchenko, E., Piddubnyi, I., Manzhura, D., Kolodiazhnyi, I., Stolnykovych, H., & Zamidra, S. (2023). *Analytical overview of the state of the land market in Ukraine*. Kyiv: KSE Agrocenter.
- [20] Puspasari, I.D. (2020). The dilemma of taxation law for small farmer. *International Journal of Religious and Cultural Studies*, 2(1), 11-18. doi: [10.34199/ijracs.2020.04.03](https://doi.org/10.34199/ijracs.2020.04.03).
- [21] Putytskyi, A. (2022). Economic inequality and economic stratification: Their types and relationship. In *Strategic priorities for socio-economic development in the context of institutional transformations in the global environment: Materials of X international scientific-practical conference* (pp. 74-78). Lviv-Torun: Liha-Pres. doi: [10.36059/978-966-397-254-1-18](https://doi.org/10.36059/978-966-397-254-1-18).
- [22] Schmalor, A., & Heine, S.J. (2022). The construct of subjective economic inequality. *Social Psychological and Personality Science*, 13(1), 210-219. doi: [10.1177/1948550621996867](https://doi.org/10.1177/1948550621996867).
- [23] Skydan, O., Vilenchuk, O., Pyvovar, P., Topolnytskyi, P., & Shubenko, I. (2023). Identification and interpretation of internal factors influencing the agricultural insurance market in Ukraine. *Scientific Horizons*, 26(10), 150-162. doi: [10.48077/scihor10.2023.150](https://doi.org/10.48077/scihor10.2023.150).
- [24] Tarasovskyi, Yu. (2023). *Ukraine's GDP fell by 29.1% at the end of 2022, according to State Statistics*. Retrieved from <https://forbes.ua/news/vvp-ukraini-za-pidsumkami-2022-roku-vpav-na-291-derzhstat-13042023-13041>.
- [25] The common agricultural policy at a glance. (n.d.). Retrieved from https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-glance_en.
- [26] The official of the State Service of Ukraine for Geodesy, Cartography. (n.d.). Retrieved from <https://land.gov.ua/>.
- [27] Therborn, G. (2020). Sweden's turn to economic inequality, 1982-2019. *Structural Change and Economic Dynamics*, 52, 159-166. doi: [10.1016/j.strueco.2019.10.005](https://doi.org/10.1016/j.strueco.2019.10.005).
- [27] Tran, T.Q., Vu, H.V., & Nguyen, T.V. (2023). Aquaculture, household income and inequality in Vietnam's coastal region. *Marine Policy*, 153, article number 105634. doi: [10.1016/j.marpol.2023.105634](https://doi.org/10.1016/j.marpol.2023.105634).

- [28] Trump, K.-S. (2020). When and why is economic inequality seen as fair. *Current Opinion in Behavioral Sciences*, 34, 46-51. doi: 10.1016/j.cobeha.2019.12.001.
- [29] Two years of the land market in Ukraine: Achievements and failures, and how war has changed it. (2023). Retrieved from <https://agropolit.com/spetsproekty/1018-dva-roki-rinku-zemli-v-ukrayini--dosyagnennya-ta-provali-i-yak-yogo-zminili-viyina>.
- [30] UNIDO and the European Union. (2021). Retrieved from <https://www.unido.org/sites/default/files/unido-publications/2022-12/UNIDO-European-Union-SOTIP-2021-en.pdf>.
- [31] Willis, G.B., García-Sánchez, E., Sánchez-Rodríguez, Á., García-Castro, J.D., & Rodríguez-Bailón, R. (2022). The psychosocial effects of economic inequality depend on its perception. *Nature Reviews Psychology*, 1, 301-309. doi: 10.1038/s44159-022-00044-0.

Дослідження агроекономічного розвитку та його впливу на соціально-економічну нерівність в Україні

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Анотація. У сучасному світі проблема нерівності набуває глобального значення і велика кількість міжнародних інституцій ставлять у числі головних своїх задач боротьбу з її проявами – економічними, соціальними тощо. Дослідження економічної нерівності саме під час воєнного стану є вкрай актуальним, адже вона, в першу чергу, негативно впливає на життя та добробут людей, провокує кризи та додаткову соціальну напруженість і, як наслідок, дестабілізує державну систему та національну економіку, які вже знаходяться у кризовому стані через воєнні дії. Метою даної роботи було проаналізувати причини соціального та фінансового розшарування українського суспільства у контексті агроекономічного розвитку. Методом статистичного аналізу була досліджена динаміка заробітних плат в Україні, зокрема, в агропромисловому секторі, а за допомогою методу вираховування коефіцієнта Джині, був розрахований індекс загального економічного розшарування. Були проаналізовані статистичні дані щодо розвитку ринку землі сільськогосподарського призначення – починаючи від припинення мораторію у липні 2021 року і до червня 2023 року. В результаті були отримані актуальні ключові показники земельного ринку в Україні, відомості щодо заробітної платні у різних галузях народного господарства у період з 2014 по 2022 рік та проведено аналіз доходів співробітників агропромислового комплексу, що виявилися нижчими за середні показники. Для більш об'єктивної оцінки була залучена статистика по найбільшим аграрним державам Європейського Союзу та зіставлена з їх показниками нерівності. Розрахунок коефіцієнту Джині продемонстрував у період з 2014 по 2022 рік зростання на 10 % нерівності розподілу доходів українських домогосподарств, проте все одно виявився нижчим за актуальні показники таких європейських країн як Німеччина, Швеція та Польща. Практична значимість роботи полягає в розробці рекомендацій щодо зменшення розриву між багатими та бідними в Україні, зокрема, в агропромисловій галузі, які можуть бути використані відповідними владними структурами задля перерозподілу аграрного ринку та оптимізації податкового законодавства

Ключові слова: соціальна несправедливість; агроекономіка; розшарування суспільства; стратифікація; глобальний голод

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Intelligent information systems of the banking sector: General characteristics and information environment

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Abstract. Due to the rapid development of digitalization and information technology, the study of intelligent information systems (IIS) in the banking sector is becoming an urgent task. Intelligent information systems are able to optimize banking processes, increase security, improve the quality of customer service, mitigate risks, and optimize internal processes of financial stability management. The purpose of this study is to reveal the potential and impact of IIS on banking management processes; to study their capabilities. To achieve this goal, this study used an analytical approach, in particular, methods of information and morphological data analysis, as well as the method of generalization, which allowed the identification of key aspects, features, and properties of intelligent information systems of the banking sector, and to provide a generalized structure of their functioning by the relevant processes. This article generalizes a group of intelligent information systems of the banking sector (IISBS), their general features and properties, proposes an innovative architecture of financial management support, and identifies their advantages in comparison with existing intelligent systems. The study proves that intelligent information systems of the banking sector are endowed with hybrid data analytics provided by deep learning methods using self-learning algorithms; are able to assess possible risks and plan strategies for their resolution; recognize unauthorized entries and suspicious transactions; thanks to virtual assistants, are suitable for robotizing management processes; and visually present the results of analysing large amounts of data in real time. The research conducted in this paper shows that the introduction of intelligent information systems in the banking

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sector is of high practical value, as it provides interactivity and personalization for customers, online interaction, and support in solving problems through various communication channels

Keywords: artificial intelligence; predictive analytics; machine learning; dashboard; chatbot; intellectual analysis; financial stability

Introduction

The introduction of digital technologies is an integral part of the digitalization of the banking sector. Digital technologies and innovations are effectively used by almost all banks in international countries. The development of digital technologies in banking institutions opens up a wide range of opportunities to improve the efficiency of banking activities, enhance the quality of service and provide innovative financial services. Digitalization of the banking sector is the process of introducing technologies and digital innovations in banking activities to improve customer experience, optimize processes and develop innovative business models. The key aspects of the use of digital technologies in banks are:

- mobile applications and online banking – customers are provided with convenient applications and online platforms for use, on the basis of which banking operations are carried out, and access to financial information is provided in real time);
- artificial intelligence (AI) and machine learning (ML) – banking institutions use AI and ML to process and analyse large amounts of data, identify patterns, forecast trends, credit scoring, and manage risks, which significantly speeds up automation and decision-making processes, increases the accuracy of data processing and the efficiency of banking operations.

It is with the introduction of digital technologies that intelligent systems (IS), which are a categorical component of information systems, are developing. The development of intelligent systems is studied in the work of Ukrainian scientist V.M. Kotsovsky (2019), which reveals the basic concepts of intelligent systems, provides the conceptual component of an intelligent information system (IIS) as a type of IS, presents the general processes of their functioning in various architectures, and suggests general approaches to knowledge representation.

In the monograph by O.G. Avrunin *et al.* (2022), Ukrainian scientists summarize the theoretical and practical aspects of the use of intelligent information systems in various fields of activity, investigate the general stages of theoretical developments and practical applications of artificial intelligence in the field of expert, problem-oriented intelligent systems, and propose modern tools for intelligent information management of economic databases. The work of the Ukrainian scientist L.D. Yaroshchuk (2019) reveals the main provisions for modelling intelligent control systems based on the classical structure of expert systems and based on existing knowledge models. In this paper, the author proposes a methodology for creating expert systems, formulates recommendations for choosing mechanisms for logical data retrieval and building a knowledge base for solving problems in various subject areas of industry. American

scientists C. Pimenta & A. Seco (2021) studied information systems in financial management using artificial intelligence, machine learning, and data analysis and proposed a subgroup of intelligent systems called financial management information systems (FMIS). The authors focused on the processes of data visualization (dashboards) used in innovative robotic platforms. It is known that the use of virtual agents (chatbots, voice bots) in FMIS systems is promising, and the authors paid considerable attention to this.

The work of the Chinese scientist M. Lai (2022) proposes a model of an intelligent financial management system (IDSS) with an innovative architecture based on data mining technology. IDSS systems use intelligent financial forecasting of management decisions based on data analysis, with a basic financial management structure and a decision support system. Currently, the Ukrainian banking sector does not fully use intelligent systems, but only introduces elements and/or tools of artificial intelligence in some of them. The work of the scientist V.P. Kravchenko (2023) analyses the current state of application of artificial intelligence tools in the banking sector and provides examples of their implementation in existing information systems.

A review of the literature of domestic and foreign scholars suggests that as of 2023, there is no single methodology for designing intelligent systems in the banking sector, so there is a problem in determining the general methodology for designing intelligent information systems and their implementation in banking institutions of Ukraine. The purpose of this study is to summarize the common features, properties, and processes of functioning of intelligent information systems, design their architecture according to a modernized structure, which will further ensure their implementation in national and/or foreign banking institutions.

Materials and Methods

The theoretical basis for this study is the work of Ukrainian scholars A.S. Dovbysh (2009), V.L. Pleskach & T.G. Zatonatska (2011), M.P. Voinarenko *et al.* (2015) and O.V. Nesterenko *et al.* (2017), which established the general concepts, development, and classification of intelligent systems, their advantages, and application in comparison with existing information systems.

Since intelligent systems cover such areas of IT technologies as artificial intelligence, machine learning, neural networks, and data mining, the methodology presented in the works of American researchers J. McCarthy (John McCarthy's Home Page..., 2023), A. Seco & A. Muñoz (2019), C. Pimenta & A. Seco (2021), Chinese researcher M. Lai (2022), as well as Ukrainian scientists M.P. Voinarenko *et al.* (2015),

A.O. Zamula (2014), V.M. Kotsovsky (2019), L.D. Yaroshchuk (2019), T. Kysil (2020) allowed systematizing general approaches to the introduction and use of modern technologies, as well as to assess their effectiveness in the management of banking institutions.

The use of the method of regulatory and index evaluation in intelligent information systems proposed by domestic scientists L. Prymostka & L. Lysenok (2008), I. Dominoва (2020) and its adapted model allowed determining the effectiveness or degree of achievement of certain regulatory or index indicators, which is used to determine the processes of financial activity. In the context of financial management, the method of regulatory and index assessment included an assessment of the bank's financial stability, where regulatory indicators such as liquidity, capitalization, profitability, and others had to meet the requirements of regulators or banking sector standards.

The visualization of data analysis methods proposed by domestic scientists O. Lezhnina *et al.* (2022), O. Zinchenko *et al.* (2022) was promising for presenting complex concepts, architecture of intelligent systems, data, and analytics results in a convenient and understandable form for employees, managers, and clients of banking institutions. In addition to predictive methods, this study used the information method and the method of morphological analysis. The method of morphological analysis was used to consider intelligent systems in terms of their structure, functions, characteristics, and basic properties. The information approach ensured an effective search for information from scientific sources on the essence and categorical differences of models of intelligent information systems, including manuals, monographs and scientific articles published in international scientific and metric databases.

This study uses the basic approaches to cognition of the banking sector's features based on the general scientific methods of induction and deduction. The method of induction made it possible to identify general trends in the formation of intelligent systems and to formulate a hypothesis about the concept of "intelligent information system of the banking sector". The method of deduction was used to formulate the general principle of functioning of intelligent systems based on innovative IT technologies, to obtain a comparative analysis of existing intelligent systems and to propose a categorical group of them in banking activities.

Using the method of generalization, the study identifies common features and properties of intelligent information systems in the banking sector, substantiates their general structure of functioning, and formulates a concept that should be followed when designing and implementing digitalization in banking institutions.

Results and Discussion

Intelligent information systems: signs and properties

Intelligent systems are widely used in various industries, including the banking sector. This is due to the increasing amount of data generated and stored by banks, as well as the need to analyse this data quickly and efficiently to make

informed decisions and improve the quality of customer service. In the banking system, IIS can be used to optimize management processes, increase efficiency, and improve the quality of customer service. An important factor in the application of IIS in the banking sector is the processing and analysis of a large amount of financial data. Banks collect a large amount of information about their customers, their transactions, credit history, etc. The IIS can automatically analyse this data, identify dependencies and trends, make forecasts, and provide effective management recommendations to bank specialists.

Since existing information systems have limitations in processing/analysing large amounts of data, do not guarantee reliability, efficiency, and do not ensure confidentiality and protection of personal information of customers, intelligent systems are a powerful tool that significantly enhances the process of optimizing and analysing large amounts of financial data, making informed decisions with high quality management performance. The issue of developing intelligent systems is a complex and multifaceted task, and it has been studied by many scientists and researchers in the field of artificial intelligence, information technology and other relevant areas. However, it is difficult to point to a specific scholar who has exclusively studied the concepts of intelligent systems' development, as it has been the subject of research by many researchers for decades. Among the scientists who have worked on the classification of intelligent systems and other aspects of artificial intelligence is J. McCarthy (John McCarthy's Home Page..., 2023), who defined the term "artificial intelligence" and classified them according to various aspects depending on their purpose, functionality and main characteristics.

As it is known, intelligent systems can be classified according to their application in various industries, and currently, scientists have identified a categorical group of financial intelligent systems that have corresponding special needs for financial activities. According to the authors, it will be important to allocate a categorical group of intelligent systems for banking management processes. Such systems should combine information technologies, methods of data analysis and artificial intelligence to ensure effective management of banking processes, risk management and informed decision-making to ensure financial stability in the face of economic changes and adverse factors.

It is intelligent information systems (IIS) that enable the search, analysis, processing, and interpretation of relevant information. Such systems recognize and process large amounts of data, providing users with "smart" recommendations, analyse structured/unstructured data, text documents, images, video and/or audio content, etc. in real time with detailed justification of the results obtained. The term "intelligent information systems" was proposed by domestic scientists O.V. Nesterenko *et al.* (2017). In their work, they summarize the concept of existing systems in various areas of their use, which significantly expands the range of their use in business, management, and administration.

The intelligent information systems of the banking sector (IISBS) should combine not only information technology, but also data mining to ensure high efficiency and effectiveness of banking operations. The IISBS should be capable of collecting, storing, processing, and analysing large amounts of data from open sources, including internal and external sources of banking institutions. These systems should use a variety of IT technologies, such as artificial intelligence, machine learning, data analytics, forecasting and image recognition, visualization, etc., which are effective tools for identifying and analysing relevant patterns, trends, and other information resources.

The fundamental contribution to the design of intelligent systems is the study of a domestic scientist (Dovbysh, 2009), which reveals the essence, properties, types of IIS, the main stages of their design and operation. The author highlights the general provisions of intelligent systems and presents methods for optimizing training parameters within the framework of information-extreme technology for analysis and synthesis of intelligent systems, which allows using training samples as decisive rules under conditions of a priori uncertainty. The researcher has identified the properties of the IIS, such as stability, controllability/self-controllability, verifiability, accuracy, reliability, and stability, which should be considered as general in the design process (Fig. 1). V.M. Kotsovsky (2019) highlights the property of the learning/self-learning process, during which the system acquires knowledge, identifies patterns, creates forecasts, makes decisions based on the information provided, based on machine learning methods using models and data analysis algorithms to gain new knowledge.

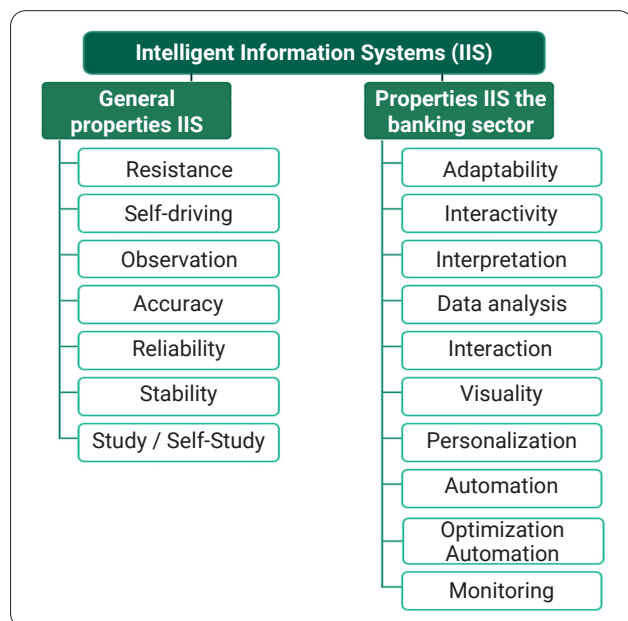


Figure 1. Properties of intelligent information systems of the banking sector

Source: summarized and supplemented by the authors based on the research of A.S. Dovbysh (2009), V.M. Kotsovsky (2019), M. Milojević & S. Redzepagic (2021)

For the banking sector, intelligent information systems, in addition to the group of general properties of IIS, should also have such properties as (Fig. 1) adaptability, which will ensure their learning in new operating conditions and gaining knowledge based on data from experience. Since, in the process of functioning, IIS can change their models, rules, strategies in accordance with changes in the environment, obtaining additional input data enables timely response to changes in difficult conditions. It is important to note such a feature as interactivity, which will provide the system with interaction with users and customers of banking institutions in order to provide information, resolve personalized issues, perform relevant functions and operations in real time through the use of virtual assistants (voice assistants, chatbots), which will significantly increase communication with customers. Quick access to information and services guarantees a personalized and convenient result of using IIS. It is worth giving the system an interpretation property that will allow detecting and recognizing data in the IIS, including text, images, video, and audio information. It is this property that will determine the optimal information for analysis, distinguishing its content by appropriate classifiers.

The main feature of any intelligent system should be data analysis. It is this ability, such as making appropriate decisions on a set of big data, that will be able to make an assessment based on well-known scientific methods (static, dynamic, Big Data) and implement appropriate decisions based on specified criteria or rules, considering many dependent/independent factors. Having analysed the experience of existing systems, it is possible to assure that no system can cooperate without interaction. With the help of various interfaces (multimedia, virtual, intelligent) that have the ability to fully engage in dialogue, recognize speech, identify emotions, ensure the execution of commands/operations at the request of customers/staff, provide information/recommendations in real time.

One of the disadvantages of intelligent information systems is the difficulty in obtaining analytical/prognostic results that significantly affect management decision-making. Therefore, it would be appropriate to present data and analysis results in systems in the form of graphs, charts, images, and other visual tools, which will make it easier for users/staff to perceive and understand information. It was the scientists C. Pimenta & A. Seco (2021) who studied this process, which is now known as visualization. Data personalization can also be identified in systems, which will ensure the process of setting up an IIS for the unique needs and requirements of a particular user when providing individual recommendations, solutions, and services, taking into account personal characteristics, preferences, context, and other relevant parameters. An important aspect of intelligent systems is optimization, which enables automation of repetitive or complex processes, detects anomalies in them, improves productivity, and ensures high efficiency, thereby eliminating human error.

Modern systems cannot function properly without timely, real-time data monitoring. It is monitoring that allows ensuring the effective operation of IIS, identifying

possible problems and responding to them in a timely manner, and includes checking the system's performance, availability, and speed; detecting intrusions and/or fraudulent activities that may require an immediate response; providing ongoing support, search and updating of IIS. As a result, it is possible to state that the proposed properties of PIS for the banking sector will make them more flexible, suitable for self-learning and adaptation, and provide effective analysis in processing large amounts of data with high-quality management decision-making.

Intelligent information systems: information environment

It is worth mentioning the work of domestic scientists V.L. Pleskach & T.G. Zatonatska (2011), which describes the information environment of intelligent systems, consisting of a fact base and a knowledge base. The authors define the concept of "intelligent automated information system" (IAIS), provide a general structure of the organization's management process by its main characteristics. It is in the work of these authors that the main components of the IAIS are presented, namely, the solver (machine output), the information environment and the intelligent interface. In the researchers' work, the information environment consists of a fact base and a knowledge base, and the intelligent interface provides a machine-human dialogue in the system, while demonstrating its learning and performance. It should be noted that such systems do not have a process of visualizing the results, which greatly complicates the interpretation of the analysis and management decision-making. Data analysis in such systems is provided by weak artificial intelligence, as it is limited in the choice of machine learning algorithms.

The process of functioning of intelligent systems is shown in more detail in the work of M.P. Voinarenko *et al.* (2015) and its main components, such as the user interface, knowledge base, interpreter and system creation module, are presented. The structure of the systems presented by the authors is mostly used by expert decision-making systems (EDMS), so the user interface is proposed to be used for entering information and commands containing parameters aimed at the process of knowledge processing and obtaining output results from the knowledge base (KB). The structure of the IIS proposed by scientists is more generally aimed at the intelligence of the use of information systems, but is limited to machine learning methods.

The information processes of an intelligent information system have been studied by domestic scientists O.V. Nesterenko *et al.* (2017), whose functioning is shown in Figure 2. As can be seen from the diagram, the user interface component is divided into input and output data. The user of the system receives the result based on the relevant data/queries. This system has the following components: data management, data processing, and machine learning. Based on the above structure, it is to be concluded that these systems have a significant drawback: they are capable of solving problems using weak artificial intelligence algorithms.

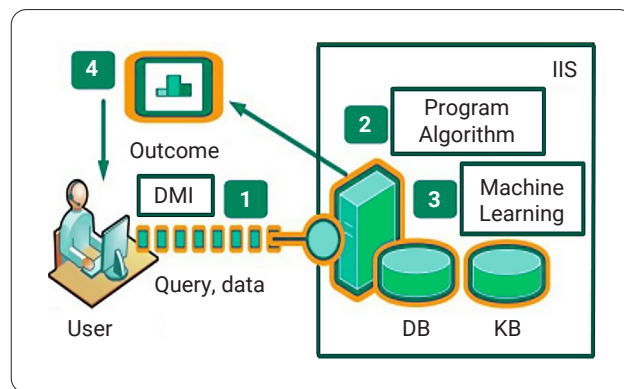


Figure 2. Functioning of information processes in intelligent information systems

Source: suggested by authors O.V. Nesterenko *et al.* (2017)

The study by the national author A.O. Zamula (2014) is aimed at improving the efficiency of management of financial and qualitative indicators of banking activities, in which methods and models of intelligent management are proposed. This paper describes the basic principles and methods of using artificial intelligence, machine learning, and data analysis to predict financial risks under the improved structure of management decision-making in banking. The structure of the hybrid intelligent system for the banking sector proposed in this paper, in addition to the user interface, contains three main modules, namely

- data management, which includes external and internal sources of information stored in the database;
- knowledge management, which contains a knowledge base relying upon the sources of conceptual description of banks and created product rules;
- model management, which has three main components: a dynamic model of the banking system, a dynamic model of the bank, and a fuzzy model of bank management.

As can be seen from the above structure (Fig. 3), hybrid systems, in comparison with the previous systems, have the advantage of forming a database of models used in data analysis, but are limited in algorithms and methods of training/self-learning. In his work, the researcher focused on fuzzy logic models, which are subject to subjectivity and complexity of interpretation, limited in solving personalized tasks, slow in the learning process, and have insufficient adaptability and accuracy of analysis.

Data mining is an important component of any intelligent system. In the work of scientists O.G. Avrunin *et al.* (2022), intelligent analysis is implemented as an extension of relational databases that combine a large amount of data with the ability to analyse, interpret and make decisions. This is the highest level of the database, which includes intelligent analysis and understanding of data to identify complex relationships and make informed decisions. Based on the results of the research, the scientists proposed the methodology of intelligent databases (IDB), which is appropriate to use in the structure of the banking sector's IIS.

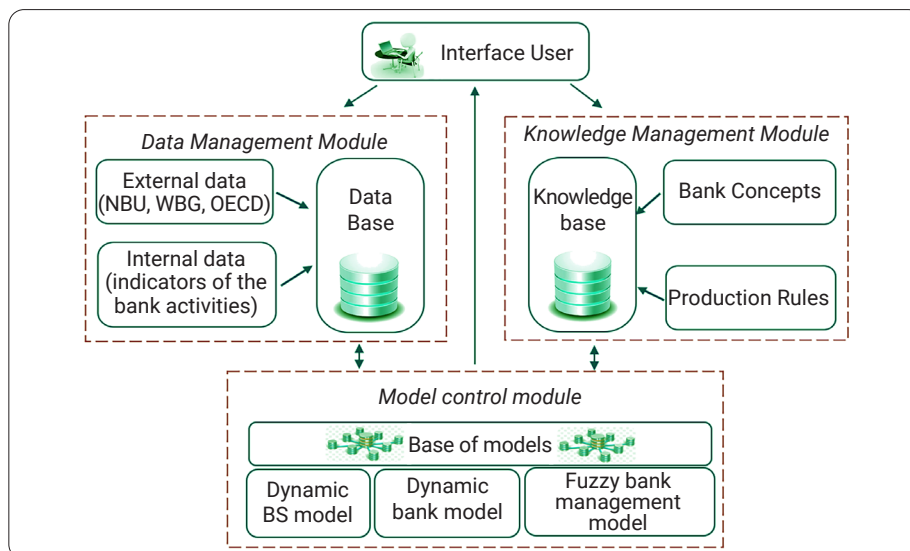


Figure 3. Information processes of intelligent information systems

Source: suggested by author A.O. Zamula (2014)

With the development of e-banking, intelligent information systems are not practical for the mass consumer in the financial sector. E-banking (internet banking) involves the use of electronic devices on the Internet to conduct financial transactions and access banking services (Domino-va, 2020). As e-banking provides opportunities for online transactions, analytics, and personalization, it encourages banks to innovate and improve customer service processes. It is for the convenience, speed, and accessibility of banking services for customers that IIS should introduce visualization of results and data analysis, as well as informative panels (dashboards). The general structure of dashboards can be interactive depending on the purpose and personalized data of the target audience. However, the main components of dashboards can be identified: controlled panels and/or filters, graphs and/or charts, tables and/or numerical data (indicators), geographic visualization (maps, markers, geo-location data), additional components (advanced analytical reports, etc.). It is important to note that dashboards can display results tailored to a specific situation or the needs of a particular user (Basyuk & Vasylyuk, 2010). A significant advantage of using dashboards is their real-time use.

According to such principles, dashboards and IIS can be implemented according to the methodology proposed by O. Lezhnina *et al.* (2022). The use of the Flask (Python) server together with ORKG library queries and the use of Pygal library visual components allows users to receive the results of the analysed information in mobile banking applications. The visualization of the obtained data is dynamic, and when the filtered results are sent to ORKG, the content of the dashboard is automatically updated. It can be noted that mobile banking has the advantage of providing users with access to banking services, checking account balances, transferring funds, paying bills, and receiving notifications of completed transactions from mobile devices online 24/7 (Zinchenko *et al.*, 2022). American scientists have focused

on data visualization processes (dashboards) used in innovative robotic platforms (Pimenta & Seco, 2021).

The use of virtual agents (chatbots, voice bots) in FMIS systems is promising, and it would be appropriate to introduce them in the banking sector's intelligent systems (Pimenta & Seco, 2021). Virtual assistants (chatbots) will provide convenient and efficient communication with the bank, improve customer experience, and provide access to financial services in real time. According to the study, virtual assistants (VAs) use semantic and deep learning based on artificial intelligence methods using neural networks and their variants, which provides natural language processing, forecasting, and personalized recommendations. In the case of FMIS, the best VA will be the main component of the customer support service in an intelligent information system. The functional diagram of such a chatbot is presented in the work of A. Seco & A. Muñoz (2019), in which the helpdesk provides simultaneous support through several channels of the user's choice.

With the development of digital artificial intelligence technologies, an important component of the IIS is the data processing module, using Data mining methods to identify useful information, patterns, templates, and trends in large data sets. This area combines methods and techniques from the fields of statistics, machine learning, artificial intelligence, databases, and data visualization. The main goal of Data Mining is to find hidden information that can be useful for decision-making, forecasting future trends, identifying associations and patterns between data. To achieve this goal, various algorithms and methods are used, such as classification, clustering, associative rules, regression analysis, outlier (anomaly) detection, forecasting, and others. Data Mining is used as a tool that allows extracting valuable information from large amounts of data to support and/or make decisions and understand and/or analyse business processes.

In the architecture of an intelligent financial management system, processes are formed by integrating a decision-making support system (DMSS) and an expert system (ES). The decision support system consists of a model base and human-computer interaction, while the expert system consists of machine analysis, a dynamic database and a knowledge base. The basis of the modernized IDSS architecture is the database, which includes a knowledge base and a model base, allowing to obtain auxiliary information about decisions by combining qualitative analysis (knowledge substantiation) and quantitative analysis (evaluation and analytics). Another component is a data warehouse and a data mining approach is proposed, in which the personalized information found reflects an inherent law in the processing of large amounts of data (Lai, 2022).

It is in the processing of Big Data that analysis from different sources of information in different formats is used. Big Data analytics allows identifying complex dependencies, trends, and patterns in data, making predictions, discovering associations and hidden knowledge. The authors

C. Pimenta & A. Seco (2021) propose a method of predictive analytics, which is a form of advanced analytics that determines the forecast using methods such as regression analysis, multivariate statistics, modelling, and forecasting. This approach to data analysis provides timely forecasting trends in economic activity in the short term (nowcasting). An important component of the intelligent system is the analytics and forecasting module, which uses artificial intelligence (AI) methods (Ghandour, 2021) to identify financial trends and predict risks, as well as assess the bank's financial performance. It is AI algorithms that enable effective management in banking institutions, which will help in making informed decisions on asset allocation, risky transactions, and financial management strategies.

Intelligent information systems: general structure

Having studied the processes of functioning of modern IIS, it is possible to present a modernized structure of the banking sector's IIS, which includes six component modules (Fig. 4)

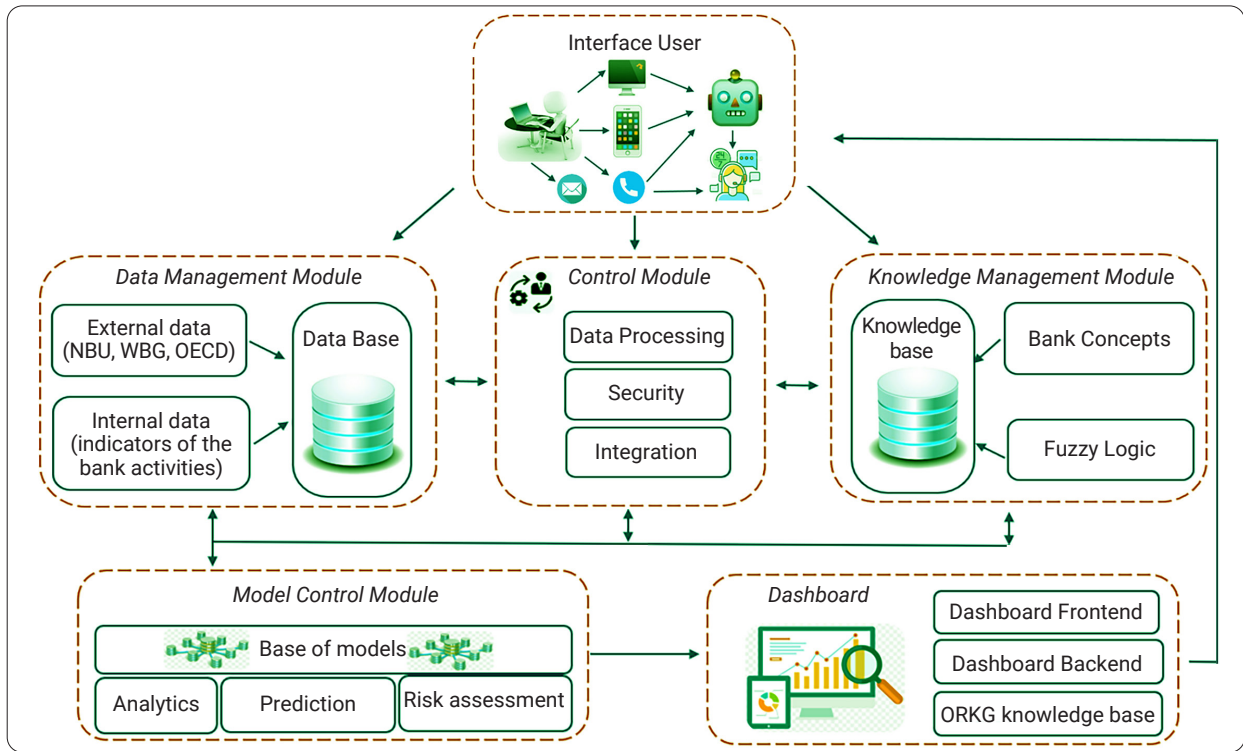


Figure 4. A modernized structural diagram of the functioning of intelligent information systems within the banking institution

Source: summarized and supplemented by the authors based on the research of A.O. Zamula (2014), C. Pimenta & A. Seco (2021), O. Lezhnina *et al.* (2022)

As it can be seen from the diagram, the user interface is responsible for collecting input information to the II system. The introduction of chatbots (voice bots) in the system will help customers perform financial transactions (money transfers, payments, checking account balances, loan applications, blocking cards, etc.), which will ensure speed and convenience for customers, online without visiting the

bank or calling the contact centre. Virtual assistants can be useful for attracting new customers by providing information about banking services, account opening procedures, credit terms and other financial opportunities. Virtual assistants can analyse customer data, transaction history, financial status, expenses, and other parameters to provide personalized advice and recommendations.

The core of the data management module is an intelligent database that stores data on customers, their financial transactions, services, and products. The database can be distributed according to the needs of the banking institution, allowing data to be stored on servers/clouds and providing access to various nodes of the II system. In the system, the management module is responsible for managing the IIS, including controlling access to the system, setting parameters, monitoring, and allocating resources among various components. This module includes the following components: data processing, which is responsible for processing and analysing data by selecting information from the database and processing it using various artificial intelligence algorithms; security, which is responsible for authentication and authorization of users, data encryption, detection, and elimination of security threats, activity monitoring, etc., integration, which is responsible for interacting and exchanging data with other systems, such as customer relationship management (CRM), payment processing systems, reporting systems, etc. (Abdalla *et al.*, 2020).

A component of an II system such as a knowledge management module will ensure the management and distribution of knowledge for banking institutions of different groups and activities. The rules developed using fuzzy logic methods contribute to the efficient processing and use of knowledge to support business processes, decision-making, and the development of banking institutions. The main functions of the knowledge management module include: knowledge storage, which provides mechanisms for preserving and integrating knowledge, ensuring its security and confidentiality by controlling access and access rights; search and selection of knowledge, which provides fast and efficient search for knowledge in the system by keywords by similarity, performs filtering, and provides personalized recommendations; analysis and updating of knowledge, which provides tools for identifying new dependencies and relationships, detecting anomalies or irrelevant knowledge,

and helps customers identify specific knowledge fragments (comments, feedback, reviews, etc.).

The model management module modified in the system will allow effectively managing the life cycle of models used for analysis, forecasting, optimization, and decision-making. This module provides centralized storage, version control, access, and management of models in an intelligent system and contains the following components: analytics, which provides the process of identifying, interpreting and communicating useful information from data and includes the use of statistical methods, mathematical models, machine learning and other techniques to identify dependencies, trends, and patterns in information for the purpose of understanding, forecasting and decision-making; forecasting, in which, based on data analysis, forecasts of future events and trends can be made, and models can be used to optimize business processes and make further decisions; risk assessment, which is responsible for the process of identifying, analysing and assessing threatening events or situations that may adversely affect the goals, projects, or activities of banking institutions, and, if identified, allows for informed decisions and measures to be taken for their effective management (Arjun *et al.*, 2021).

The dashboards added to II systems generate output information for analytical reports and graphs that provide clear and comprehensive information about the bank's financial stability. This helps both users and bank management to visually receive information to simplify decision-making and relevant financial management strategies. The functioning of the proposed IIS framework in the banking sector will help banking institutions to increase the return on equity, improve customer service more efficiently and effectively with high real-time accuracy, predict financial stability, and ensure financial stability. As a result, let us compare the key aspects of intelligent information systems in the banking sector with the existing intelligent systems (Table 1), which were considered in this study, with the proposed AI system of the banking sector.

Table 1. Main features of intelligent information systems

Main features of IIS	A type of intelligent information systems					
	IIS	IAIS	IDSSBM	FMIS	IDSS	IISBS
Data analytics	big data	big data	fuzzy logic	predictive	data mining	hybrid
Methods of artificial intelligence	Machine learning	Neural networks	Expert systems	Deep learning	Deep learning	Deep learning
Prediction	supervised learning	supervised learning	supervised learning	unsupervised learning	unsupervised learning	reinforcement learning
Robotization of processes	absent	absent	absent	chatbots	absent	chatbots, voice bots
Risk assessment	absent	absent	absent	present	absent	present
Planning	absent	absent	absent	absent	absent	present
Cybersecurity	absent	absent	absent	present	absent	present
Visualization of processes	absent	absent	absent	present	absent	present

Source: developed by the authors based on the research of scientists O.V. Nesterenko *et al.* (2017), V.L. Pleskach & T.G. Zatonatska (2011), A.O. Zamula (2014)

Judging by the results obtained, it can be concluded that the proposed model of the banking sector's IIS is powerful and efficient, providing accurate data analysis, clear decision-making, and personalized services. Intelligent information systems in banks have a high potential for use in banking, which will significantly increase the efficiency, accuracy, and quality of financial transactions and the banking system as a whole. II systems are becoming an important tool for decision-making support, customer interaction, and risk management. However, it is worth noting that research and development is ongoing to expand the functionality of II systems and improve them for widespread implementation in banking institutions of various groups and activities. It is possible to assume that intelligent information systems will modernize the information systems of electronic banking and mobile banking, which were studied by O. Moroz (2019) and will increase their efficiency in functioning. In addition, it will be appropriate to adapt intelligent information systems on crowdfunding and crowdsourcing platforms, which will lead to significant benefits for all participants in the financing process (Leonov *et al.*, 2019; Tanklevska *et al.*, 2023).

Summarizing the results of the study, it can be said that these intelligent information systems are able to show high potential in risk management, optimize management processes and plan strategic decisions to increase the level of financial sustainability and stability.

Conclusions

The research conducted in this paper shows that intelligent information systems are a powerful tool in banking. Based on the results of the analysis, the paper substantiates the properties of II systems that should be observed when designing them. Conclusions are drawn: Firstly, the proposed intelligent systems use analytical methods, algorithms for automatic analysis and interpretation of large amounts of data, which greatly contributes to understanding trends, customer demand, considering all possible risks. Secondly, intelligent information systems should use artificial intelligence and machine learning to automate decision-making processes, which will help with the analysis of customer data, previous transactions, and other behavioural factors. This is what provides personalized recommendations and offers to customers in optimizing credit risks, and will help improve customer service processes. Thirdly, intelligent information systems in banks can detect and prevent fraud and cyberattacks, and should use anomaly detection algorithms, network analysis, and

machine learning to identify suspicious activity, which will significantly protect the system from unauthorized access to banking information. In addition, intelligent information systems in banks should provide interactivity and personalization for customers, provide online interaction opportunities, and provide support in solving problems through various communication channels.

The article confirms the hypothesis that the proposed model of IIS in the banking sector is capable of analysing large amounts of data using algorithms and machine learning methods, allows creating forecasts of possible risks, visually providing customers with personalized information, and recognizing unauthorized logins and suspicious transactions. The development of intelligent information systems is relatively rapid, and in the future, they will be supplemented by financial analytics methods and models, which will allow for a clearer assessment of external factors affecting the financial stability of banking institutions. This approach allows for a full analysis of the current economic situation and monetary and banking statistics: SWOT analysis, analysis of the banking services market, the market share held by the bank, its position among competing banks; analysis of assets, liabilities, liquidity, profitability; structural analysis of assets and liabilities; financial risk analysis. Financial sustainability in intelligent information systems is enhanced by the ability of IIS to analyse and forecast, respond quickly to changes, automate processes, and improve risk management, and help ensure the stability and reliability of the banking sector.

Hence, it is to be concluded that intelligent information systems are designed to optimize the banking sector's performance, help banks analyse and understand large amounts of financial data, make informed decisions, and improve the quality of customer service. IIS are becoming an integral part of the modern banking sector and continue to develop, providing innovative digitalization opportunities. In the future, promising areas in this context will include research aimed at developing AI models that help banks identify and assess risks associated with lending, investments, and financial transactions, as well as research related to the development of methods for detecting and responding to cyber threats.

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Conflict of Interest

None.

References

- [1] Abdalla, A., *et al.* (2020). *Cybersecurity and information technologies*. Kharkiv: DISA PLUS.
- [2] Arjun, R., Abhisek, K., & Suprabha, K. (2021). Developing banking intelligence in emerging markets: Systematic review and agenda. *International Journal of Information Management Data Insights*, 1(2), article number 1000126. doi: 10.1016/j.ijime.2021.100026.
- [3] Avrunin, O.G., Vladov, S.I., & Petchenko M.V. (2022). *Intelligent automation systems*. Kremenchuk: "NOVABUK". doi 10.30837/978-617-639-347-4.
- [4] Basyuk, T.M., & Vasylyuk, A.S. (2010). *Data visualization methods in distributed systems*. *Bulletin of the National University of Lviv Polytechnic*, 673(1), 24-31.

- [5] Dominova, I. (2020). Evaluation of the effectiveness of risk management of electronic banking based on the regulatory index model. *Accounting & Finance*, 1(87), 91-99. doi: [10.33146/2307-9878-2020-1\(87\)-91-99](https://doi.org/10.33146/2307-9878-2020-1(87)-91-99).
- [6] Dovbysh, A.S. (2009). *Basics of designing intelligent systems: A study guide*. Sumy: Sumy State University.
- [7] Ghandour, A. (2021). Opportunities and challenges of artificial intelligence in banking: Systematic literature review. *TEM Journal*, 10(4), 1581-1587. doi: [10.18421/TEM104-12](https://doi.org/10.18421/TEM104-12).
- [8] John McCarthy's Home Page. (2023). Retrieved from <http://www-formal.stanford.edu/jmc/>.
- [9] Kotsovsky, V.M. (2019). *Intelligent information systems lecture notes*. Uzhgorod: UNU.
- [10] Kravchenko, V.P. (2023). Modern practice of application of artificial intelligence in the banking field. *Modern Engineering and Innovative Technologies*, 25(4), 62-67. doi: [10.30890/2567-5273.2023-25-04-066](https://doi.org/10.30890/2567-5273.2023-25-04-066).
- [11] Kysil, T. (2020). Operation algorithm of intellectual bank system. *Modeling and Information System in Economics*, 100, 93-103. doi: [10.33111/mise.100.7](https://doi.org/10.33111/mise.100.7).
- [12] Lai, M. (2022). Smart financial management system based on data mining and man-machine management. *Wireless Communications and Mobile Computing*, 2022, article number 2717982. doi: [10.1155/2022/2717982](https://doi.org/10.1155/2022/2717982).
- [13] Leonov, S., Yarovenko, Y., Boiko, A., & Dotsenko, T. (2019). Prototyping of information system for monitoring banking transactions related to money laundering. *SHS Web of Conferences*, 65(1), article number 04013. doi: [10.1051/shsconf/20196504013_M3E2_2019](https://doi.org/10.1051/shsconf/20196504013_M3E2_2019).
- [14] Lezhnina, O., Kismihók, G., Prinz, M., Stocker, M., & Auer, S. (2022). A scholarly knowledge graph-powered dashboard: Implementation and user evaluation. *Frontiers in Research Metrics and Analytics*, 7. doi: [10.3389/frma.2022.934930](https://doi.org/10.3389/frma.2022.934930).
- [15] Milojević, M., & Redzepagic, S. (2021). Prospects of artificial intelligence and machine learning application in banking risk management. *Journal of Central Banking Theory and Practice*, 10(3), 41-57. doi: [10.2478/jcbtp-2021-0023](https://doi.org/10.2478/jcbtp-2021-0023).
- [16] Moroz, O. (2019). Benefits of using hybrid mobile apps and progressive web apps in business. *Herald of Agrarian Science of the Black Sea Region*, 1, 96-102. doi: [10.31521/2313-092X/2019-1\(101\)-14](https://doi.org/10.31521/2313-092X/2019-1(101)-14).
- [17] Nesterenko, O.V., Kovtunets, O.V., & Falovskyi, O.O. (2017). *Intelligent information systems and technologies. Introductory course: Textbook*. Kyiv: National Academy of Management.
- [18] Pimenta, C., & Seco, A., (2021). *Financial management information systems (fmis) – project guide: Strategic, functional, technological, and governance issues in the design and implementation of new platforms for public financial management systems*. Washington: Inter-American Development Bank. doi: [10.18235/0003342](https://doi.org/10.18235/0003342).
- [19] Pleskach, V.L., & Zatonatska, T.G. (2011). *Information systems and technologies at enterprises: Textbook*. Kyiv: Knowledge.
- [20] Prymostka, L., & Lysenok, L., (2008). [Cumulative risk of the bank: Evaluation method based on regulatory index model](https://doi.org/10.33146/2307-9878-2008-1(147)-34-38). *Visnyk of the National Bank of Ukraine*, 5(147), 34-38.
- [21] Seco, A., & Muñoz, A. (2019). *Asistentes conversacionales virtuales en las administraciones tributarias*. Washington: Inter-American Development Bank. doi: [10.18235/0001901](https://doi.org/10.18235/0001901).
- [22] Tanklevska, N., Cherniavska, T., Skrypnyk, S., Boiko, V., & Karnaushenko, A. (2023). Financing of Ukrainian agricultural enterprises: Correlation-regression analysis. *Scientific Horizons*, 26(8), 127-139. doi: [10.48077/scihor8.2023.127](https://doi.org/10.48077/scihor8.2023.127).
- [23] Voinarenko, M.P., Kuzmina, O.M., & Yanchuk, T.V. (2015). *Information systems and technologies in organization management: Training manual for students*. Vinnytsia: Edelweiss & K.
- [24] Yaroshchuk, L.D. (2019). *Intelligent control systems: Expert systems – fundamentals of design and application in automation systems*. Kyiv: KPU named after Igor Sikorsky/
- [25] Zamula, A.O. (2014). *Methods and models of intelligent management of banking activity*. (Doctoral dissertation, Donetsk National Technical University, Donetsk, Ukraine).
- [26] Zinchenko, O., Kysil, T., & Moskalenko, N. (2022). Development of interactive Dashboards for Data Science models. In *The IV International scientific and practical conference. Mathematics. Information Technology. Education* (pp. 80-81). Lutsk: Lesya Ukrainka Volyn National University.

Інтелектуальні інформаційні системи банківського сектору: загальна характеристика та інформаційне середовище

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Анотація. У зв'язку з стрімким розвитком цифровізації та інформаційних технологій, актуальним завданням постає дослідження інтелектуальних інформаційних систем (ІІС) в банківському секторі. Саме інтелектуальні інформаційні системи здатні забезпечити оптимізацію банківських процесів, підвищити рівень безпеки, а також покращити якість обслуговування клієнтів, зменшити ризики та оптимізувати внутрішні процеси управління фінансовою стійкістю. Метою поточного дослідження є розкриття потенціалу та впливу ІІС на процеси управління банківської діяльності; вивчення їх можливостей. Для досягнення поставленої мети в даному дослідженні було використано аналітичний підхід, зокрема, методи інформаційного та морфологічного аналізу даних, а також метод узагальнення, що дозволило виділити ключові аспекти, ознаки та властивості інтелектуальних інформаційних систем банківського сектору, привести узагальнену їх структуру за відповідними процесами функціонування. У даній статті проведено узагальнення групи інтелектуальних інформаційних систем банківського сектору (ІІСБС), їх загальні ознаки та властивості, запропоновано інноваційну архітектуру підтримки фінансового управління, визначено їх переваги в порівнянні з існуючими інтелектуальними системами. У результаті дослідження доведено, що інтелектуальні інформаційні системи банківського сектору наділені гібридною аналітикою даних, що забезпечується методами глибокого навчання з використанням алгоритмів самонавчання; здатні оцінити можливі ризики та запланувати стратегії їх вирішення; розпізнають несанкціоновані входи та підозрілі транзакції; завдяки віртуальним асистентам, придатні роботизувати процеси управління; візуально надавати результати аналізу великих обсягів даних в режимі реального часу. Проведені в праці дослідження свідчать, що запровадження інтелектуальних інформаційних систем в банківському секторі мають високу практичну цінність, так як забезпечують інтерактивність та персоналізацію для клієнтів, можливості онлайн-взаємодії, надають підтримку у вирішенні проблем через різні канали комунікації

Ключові слова: штучний інтелект; прогностична аналітика; машинне навчання; дашборд; чат-бот; інтелектуальний аналіз; фінансова стійкість

**Financing innovations in the agricultural industry as a component
of the digital development of Ukraine's economy**

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Abstract. Innovative development of the economy is a condition for stable growth, which holds particular importance for the agricultural sector, elevating the management of biological assets to a significantly higher level. This study aims to determine the potential for innovative development in the agricultural sector of Ukraine and investigate the peculiarities of its financing. General scientific methods and hermeneutic methods were applied, along with statistical and correlation methods, to identify the connection between influencing factors. Tabular and graphical methods were used to present the results, and generalization was employed for drawing conclusions. The study assessed Ukraine's positions in the Global Innovation Index (2014-2022), which is relatively low, decreasing from 63 to 57 over the period. However, it shows potential in components like human capital, the business environment, and scientific research. The dependency of the growth of agricultural GDP on various factors was identified through correlation and variance analysis, particularly through the advancement of innovations. The structure of GDP dynamics reveals a decline in the agricultural sector by 28% in the wartime of 2022 compared to 2021, while the information and telecommunication sector only decreased by

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7%. If the pre-war level of government spending on financing agricultural innovations was 80% of the total, covering only the reproduction of conditions for the formation of scientific products, even raising it to 90% during the wartime does not meet real needs. Scientific and educational expenditures of the Ministry of Agricultural Policy and Food from 2018 to 2023 decreased by 22% in terms of funds, while their share increased from 4.45% in 2018 to 8.57% in 2023 due to the overall decrease in funding by 67%. Based on the assessment of the state of financing innovations in the agricultural sector to enhance them, a systematic approach to choosing financing sources was proposed. An optimal financing scheme for agricultural innovations was built based on consolidated sources under the conditions of forming a financial cluster. The practical significance of the research lies in the possibility of using its results in developing a strategy for post-war recovery of the agricultural sector. This involves evaluating the effectiveness of models for financial support of innovative development

Keywords: funding sources; scientific support; budget; digitization; financial cluster

Introduction

The digital direction of economic development worldwide shapes the knowledge economy. The tools of this economy are widely applied in the agricultural sector, where the diverse nature of production, spatial stability, and cyclical processes logically structure into a comprehensive system through the application of digitalization tools. This contributes to a rapid increase in the competitiveness of enterprises utilizing digitalization tools.

In wartime conditions, according to researchers and the relevant ministry, the value-added chains of the agricultural sector have significantly distorted due to disruptions in internal logistics and export-import operations concerning geography and production structure, dependence on “grain contracts” under the auspices of the UN, energy and fuel crises, market declines in material resources such as seeds, plant protection agents, fertilizers, animal feed, loss of territories for operations due to active combat, disruptions in production infrastructure, deterioration of enterprise production capacities, loss of human capital due to forced migration and mobilization, cessation of direct government support and compensation for destroyed production assets, and a decline in the purchasing power of the population. As a result, financing for the agricultural sector is prioritized to ensure at least zero profitability, leading to minimal expenditures on innovations in these conditions.

However, post-war reconstruction will demand unconventional steps to restore economic and agricultural potential, and one such step is innovative development. For the agricultural sector, this involves the creation and implementation of digital and nanotechnologies, the utilization of achievements in bioeconomics, organic farming, green economics, and the application of renewable energy resources. In turn, smart economic technologies require new approaches to financing, expanding their directions, sources, and efficiency. This is essential because the digitization of the agricultural sector is intensifying globally, becoming significant not only for developed nations but also for third-world countries. Therefore, domestic agriculture in innovative development needs to align with the best global practices.

Analysing the vision of the future of digital agriculture formulated by the Food and Agriculture Organization

(FAO), the Organization for Economic Cooperation and Development (OECD), and the World Bank, one dominant narrative revolves around digital technologies as a solution to food security and hunger issues. The imperative of sustainable development supports the need for digitizing agriculture. The assessment of the European Union’s “From Farm to Fork” (F2F) strategy, launched in 2020, aiming for a comprehensive transition to sustainable development in the European agri-food sector, indicates that political will alone will not achieve its ambitious goals. Success largely depends on innovations, both scaling existing ones and developing entirely new ones.

Global scientific thought explores new digital technologies and services available to farmers for resource acquisition, digital financing, and access to management information. The key challenge lies in the unequal accessibility of digital technologies for different groups of farmers, and scholars suggest investing in state research and development works (R&D) to limit market concentration. Agricultural technology issues are linked to the possibility of changing financing, as digital technologies alter the configuration of the agricultural financial landscape. As digital technologies reshape decision-making in agricultural production, it is crucial to determine how these technologies can be used not only for private goods but also for public goods, particularly ecological purposes. Global challenges such as climate change, global warming, extreme weather catastrophes, and unexpected disruptions are growing concerns for the economy, prompting the study of new advanced possibilities of digital technologies.

High-level political documents dedicated to the future of global digital agriculture and sustainable food systems underscore the need for a careful assessment of the contribution digital agricultural innovations can make to addressing 21st-century challenges. The role assigned to digital technologies by international entities in influencing the future of food, financing, design, management, and implementation of digital agricultural innovations is a critical aspect. Regulating this process in Ukraine requires scientific support. Therefore, researching the financing of innovations in the agricultural sector as a component of Ukraine’s digital economic development is a relevant scientific task.

The goal of this study is to determine the potential for financing the innovative development of Ukraine's agricultural sector in the conditions of economic digitalization. The research task is to assess the current state of innovations in the agricultural sector, their funding sources, and the efficiency of financing models for post-war recovery based on potential assessment.

Literature Review

The essence of the digital economy, as defined by researchers, lies in "the use and dissemination of knowledge in all fields and sectors of the economy, as well as the creation of knowledge to develop intellectual potential, utilize high-intellectual human capital to enhance the competitiveness of the national economy, and create a new innovative base for its development" (Maslak *et al.*, 2020). It is also studied as the economy of spatial knowledge, new knowledge infrastructure through the role of technology-based business services in national innovation systems (den Hertog & Bilderbeek, 2001), and so on. Generally, it is recognized that the knowledge economy is based on the development of human capital, the use of information technologies, highly skilled personnel, the activation of innovative activities, and it predominantly specializes in providing services and using high-intellectual labour.

Additionally, it is noted (Birner *et al.*, 2021) that digital agriculture has extensive opportunities for accelerating transformation and is evolving through private firms, including well-known resource production firms, global software companies, and startups that are new to agriculture. The features of innovation process in the agricultural sector are revealed by researchers in terms of innovative marketing tools to enhance the competitiveness of agricultural enterprises (Holysheva, 2021). This includes two components of innovative marketing in the management of agricultural enterprises: innovation marketing (product innovation: biological innovations; technology innovation: technical and technological innovations; service innovation: social, economic, and organizational innovations) and innovation in marketing (innovations in product, price, communication, and distribution policies of agricultural enterprises).

From this, it can be observed that innovation financing also has a dual significance, both as the allocation of funds from sources for the creation or implementation of innovations and as innovative financing methods inherent in the digital economy: blockchain and cryptocurrencies, fintech, mobile financial applications, financial and accounting management, electronic money, robo-advisors, insurance technologies, crowdfunding, P2P lending, etc. Institutional determinants of innovation development (Honcharenko *et al.*, 2019) predict that the implementation of justified alternative scenarios of innovation development should be based on a corresponding concept aimed at optimizing resources. In this approach, in the projection to financing, the determination of the optimal combination of resources and results of innovative activity cannot be reduced solely to direct economic benefits.

The need for activating innovative activity to ensure food security, carrying out innovative industrialization (Osetsyki & Kulish, 2020), was discussed in the pre-war period of innovation, in the agricultural sector in the context of the development of European integration (Dorosh-Kizym *et al.*, 2017). With the consideration of industry losses from war and the needs for its recovery, innovation issues have become paramount. Researchers have also considered the problems of financing the innovative development of the agricultural sector in terms of expenses and sources of coverage (Radchenko, 2023; Roieva *et al.*, 2023), indicating the dynamics of the share of innovation-active enterprises and their expenditures on innovative activities. These indicators do not show a clear trend of growth, necessitating the stimulation of innovative activities of enterprises, especially at the state level. The insufficient involvement of the state in the digitization process in enterprises is also confirmed by the reduction of state funding for innovative activities of enterprises.

Researchers have described the functioning of typical financing models based on the amount of required financial resources, terms, their cost, and the possibility of attraction (Sus *et al.*, 2023). These researchers have analysed a cluster financing model that can be applied to the implementation of important and valuable innovative projects, allowing to combine and stimulate all participants in the innovation process to achieve the planned result with optimal financing, diversify risks, and objectively assess the borrower's activity, particularly in terms of the efficiency of using financial resources in the implementation of an innovative project. The researchers have also justified the need for the formation of program innovative development packages (Shpak & Fedorchuk, 2021) while adhering to the requirements of innovative resource-environmental safety of economic activities, purposeful and consistent transition to a sustainable development model, which means simultaneous solution of economic, social, and environmental problems of society, and so on.

Innovation and its dissemination are one of the priorities of the Ministry of Education and Science of Ukraine, specifically focusing on the development of the science sector and the activation of innovative activities to increase the prestige of Ukrainian science, ensure industrial competitiveness, and promote the development of high-tech production by tripling the knowledge intensity of GDP. This includes addressing global challenges through collaboration with leading countries and engaging with the scientific diaspora (MES, 2023). Additionally, innovation in the agricultural sector is under the purview of the Ministry of Agrarian Policy and Food of Ukraine, particularly through state funding for science and education in the agricultural field (MAPF, 2023).

According to researchers from the Ukrainian Institute of Scientific and Technical Information (Pisarenko *et al.*, 2023), the global agriculture sector, due to the evolutionary development of technologies, is currently in the 4.0 stage ("Agriculture 4.0"). It is oriented towards the use of

environmentally friendly natural resources such as solar and seawater, employing advanced innovative technologies in precision and smart agriculture. This includes genetic modification, nanobiotechnology, non-soil plant cultivation, vertical farming (based on hydro-, aqua-, and aeroponics), as well as complex technological systems like satellite navigation, robots, drones, 3D and 4D printing of food products, the Internet of Things, blockchain, and more. It is predicted that the next stage of evolution, "Agriculture 5.0," will be based on comprehensive automation of agri-food production using various forms of artificial intelligence.

Considering the overall state of innovation financing in the agricultural sector and the partially formed directions discussed by researchers, there is a need for an in-depth study of the state and prospects of innovation financing in the agricultural industry as a component of Ukraine's digital economic development.

Materials and Methods

The methodological basis of the conducted research is a systemic approach, which is applied to reflect the connections between the studied processes. To obtain new results in the research, interdisciplinary scientific methods were utilized, including the systematization of the regulatory framework for innovation development; comparative analysis – when examining funding sources; hermeneutic method – for research definitions of concepts such as agricultural innovations, financial clusters, statistical analysis – to identify the correlation between selected factors influencing the development of digitization of the economy on the level of the agricultural GDP; generalization – for formulating conclusions. The research employed graphical and tabular methods for visually presenting the research results. This includes depicting the dynamics of the global innovation index and GDP volumes, as well as highlighting the results of statistical correlation analysis of factors influencing the agricultural GDP. The research methodology takes into account the fact that the transition to a digital economy is carried out with a key role played by ICT, considering that the volumes significantly impact the efficiency of the economy's functioning and all its sectors. The dynamics of GDP volumes and the structure of specific economic sectors in Ukraine from 2014-2022 were analysed to determine the share of digital services and compare their growth rates with the agricultural sector.

The main indicators for evaluating innovation development were determined based on regulatory documents and analysis of scientific sources. Initial data for calculating the correlation of factors influencing the agricultural GDP were selected, considering general trends in the development of the digital economy and data available for analysis. Regression statistics and analysis of variance were performed using the "Data Analysis" package in Excel. Analysis of variance was used to test hypotheses about the relationship between a specific feature, namely the volume of agricultural GDP and the studied factors, to establish their degree of influence and interaction. Regression

analysis predicted methods for building a model of interaction between innovation expenses and the volume of agricultural GDP, methods for determining the parameters of the model, and checking its reliability.

Regarding state support for innovation in the agricultural sector, methodological approaches and generalizations were made based on the directions of funding for science, scientific and technical activities, and education. The scheme of the financial cluster mechanism for the needs of financing agricultural innovation development was constructed based on an algorithm, the basic steps of which were determined by the regulatory field and the practice of innovation activities and methods of its assessment.

The research is based on legislative documents, including Law of Ukraine No. 1667-IX "On Stimulating the Development of The Digital Economy in Ukraine" (2021, July), Order of the Cabinet of Ministers of Ukraine No. 526 (2019, July), Law of Ukraine No. 40-IV "On Innovation Activity" (2002, July), Law of Ukraine No. 3715-VI "On Priority Areas of Innovation Activity in Ukraine" (2011, September), Resolution of the Cabinet of Ministers of Ukraine No. 13 (2018, January), Resolution of the Cabinet of Ministers of Ukraine No. 1056 (2016, December), as well as calculations and forecasts of the Government of Ukraine and International Organizations regarding the state of the research object. Generalization and analysis of data using the provided methodological-informational toolkit allow revealing the features of financing innovations in the agricultural sector as a component of Ukraine's digital economic development.

Results and Discussion

According to the research conducted by the World Bank Group's Enabling the Business of Agriculture (EBA), which collects global data on regulations affecting farmers, indicators supporting agricultural business development provide comparisons of regulatory acts related to agricultural resources, plant health, access to financing and markets. They demonstrate variations among countries in the effectiveness of implementing regulatory acts. In 2019, the thematic score for EBA in Ukraine was 67.40 out of 100, with specific scores as follows: seed supply – 54.93; fertilizer registration – 43.33; water provision – 60.00; machinery registration – 80.65; livestock conditions – 65.00; plant protection – 100.00; certified food trade – 65.29; access to finance – 70.00 (Enabling the Business of Agriculture, 2019). In other words, the financial resources available to Ukrainian farmers, encompassing funds for current and investment activities, were relatively high, even by international standards, aligning with the overall state of the innovation economy.

Ukraine's position in the Global Innovation Index (GII, 2023) and its components, as shown in Figure 1, indicates minimal changes from 2014-2022. It held the 63rd position in the country rankings in 2013, reaching its highest level in 2018 at 43, but it decreased to 57 in 2022. The breakdown of the index components reveals that the business environment, human capital and research, creativity, knowledge,

and research results are stronger indicators. On the other hand, regulatory environment, market development, and

information and communication technologies are considered weaker aspects (Tkach & Dendebera, 2023).

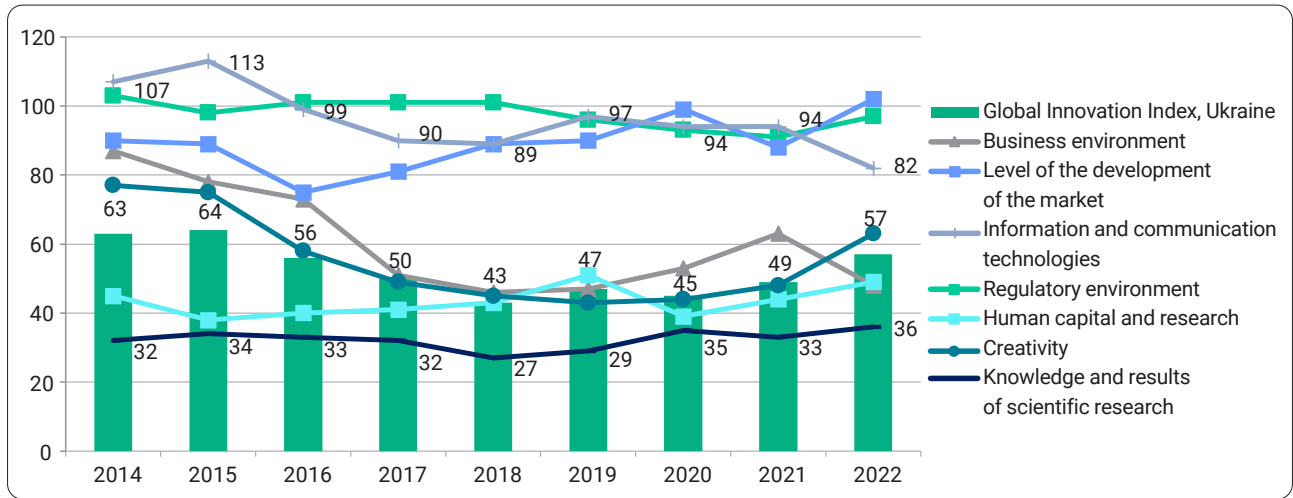


Figure 1. Dynamics of the Global Innovation Index and its components for Ukraine for 2014-2022

Source: developed by the authors according to the Global Innovation Index (2023)

According to the data from the Institute of Intellectual Property (2023), among the key indicators of innovation development analysed by researchers and applicable to the agricultural sector, the following are used: human resources or potential characterized by the number of people with higher education and those engaged in lifelong learning; digitization through broadband internet coverage; the number of people with basic digital skills; finances in terms of spending on research and development in the public sector, venture fund expenditures, state support for research and development carried out by commercial structures; investments from the commercial sector, including spending on non-research-related innovations;

the use of information and communication technologies (ICT); sales of innovative products; environmental sustainability, including resource productivity, atmospheric emissions, and ecological technologies, among others.

The dynamics of GDP volumes and the share of specific economic sectors in Ukraine from 2014 to 2022, as shown in Figure 2, indicate that the decline in agricultural GDP occurred more rapidly than in the ICT sector. If the share of the ICT sector in the agricultural GDP was 33% in 2014, it reached 56% by 2022. The decline in the volume of the agricultural sector in the war-torn 2022 compared to 2021 was 28%, while the ICT sectors experienced only a 7% decline.

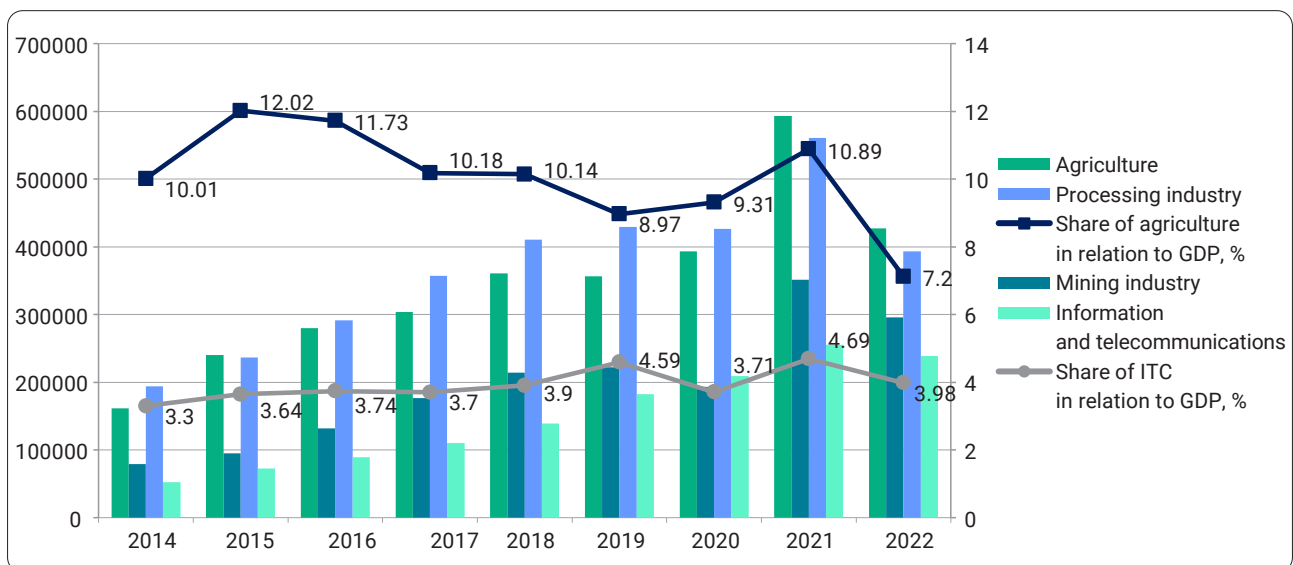


Figure 2. Dynamics of GDP volumes and the share of individual branches of the economy of Ukraine for 2014-2022, UAH million, %

Source: developed by the authors based on the data from the State Statistics Service of Ukraine (2023)

Considering the general trends in the development of the digital economy and the data available for analysis, the initial data were selected for the calculation of the correlation of factors influencing the GDP of the agricultural sector (Table 1).

Conducting statistical calculations based on the data of factors affecting the GDP of the agricultural sector demonstrate that the development of the ICT industry in the country has a rather significant effect on the basic indicator (Table 2).

Table 1. Initial data for calculating the correlation of influencing factors on the GDP of the agricultural sector

Year	GDP agricultural sector, million UAH y	The share of ICT in GDP, % x_1	Lending, million UAH x_2	Budgetary support, million UAH x_3	Investments, million UAH x_4	Production taxes, million UAH x_5	Profitability, % x_6
2014	161 145	3.30	55 335	5 135	18 796	1 596	9.3
2015	239 806	3.64	48 425	4 143	30 154	3 078	30.5
2016	279 701	3.74	55 374	4 075	50 480	1 934	30.4
2017	303 419	3.70	59 706	10 532	64 234	2 677	25.6
2018	360 998	3.9	67 675	13 054	66 104	2 862	16.5
2019	356 563	4.59	61 600	13 020	58 555	2 921	14.2
2020	393 077	4.96	61 486	13 496	50 189	3 783	16.1
2021	593 367	4.69	82 600	12 800	49 127	4 206	40.3

Source: built by the authors based on State data Statistics Service of Ukraine (2023)

Table 2. Results of the statistical correlation analysis of factors influencing the GDP of the agricultural sector for 2016-2022

Year	y	x_1	x_2	x_3	x_4	x_5	x_6
2016	1						
2017	0.791226	1					
2018	0.908293	0.587056	1				
2019	0.722236	0.770969	0.712989	1			
2020	0.492585	0.413989	0.43013	0.687041	1		
2021	0.853102	0.815869	0.637284	0.67397	0.32218	1	
2022	0.519694	0.114487	0.346356	-0.13367	0.10044	0.442209	1

Source: "Excel data analysis" program

Regression statistics and variance analysis using the Excel Data Analysis package show: multiple $R = 0.999753$, R -squared = 0.999507, normalized R -squared = 0.996546, standard error 7520.138. The equation of dependence of agricultural GDP on the selected influencing factors is as follows:

$$Y = -550393.9 + 69258.5x_1 + 7.64x_2 - 6.57x_3 + 1.22x_4 + 36.68x_5 + 1417.68x_6, \quad (1)$$

where x_1 – the share of ITC in the total economic GDP, x_2 – agricultural lending, x_3 – budget support, x_4 – agricultural investments, x_5 – taxes on agricultural production, x_6 – profitability of activity.

Calculations show that the agricultural GDP is largely shaped by the factors presented in the model, according to the determination coefficient close to 1. The actual value of the Fisher criterion ($F_{\text{calculated}} 337.57$) exceeds the critical value ($F_{\text{critical}} 0.041$). The highest degree of dependence, and therefore influence on GDP growth, is attributed to the share of the digital economy. Following in descending order are profitability, tax incentives, financing, with

budgetary support showing a neutral impact. For a more precise analysis, deeper samples are needed for factors, with a much longer lag over the years, at least 15 years. However, statistical, and analytical data closed during the period of martial law postpone such analysis into the future. The ability to measure the impact of innovations on the GDP of the agricultural sector contributes to the selection of effective management decisions, prioritizing the funding of innovative development.

The imposition of martial law has redirected the economy exclusively towards the needs of national security and defence. State programs for financing innovations have nearly folded, either being carried out on a residual basis or on a grant basis with funds from Ukraine's partners. Legislative regulation of the development of research and innovation infrastructure during this period supports directions (programs): funding for scientific research, digital transformation of education and science, funding for strategic priorities (indicators by 2032), support for science from international partners, and so on. The funding of strategic priority areas of

innovation activity, “Technological renewal and development of the agro-industrial complex” in terms of technology development and implementation from 2020-2022 through budgetary funds, is provided in Table 3. Budgetary funding for strategic priorities in innovation

activity and technology transfer activity in Ukraine under priority 4, “Technological renewal and development of the agro-industrial complex,” among the seven medium-term priorities in 2022 amounted to 150.40 million UAH, or 71.7% of the 2021 level.

Table 3. Financing according to the direction “Technological renewal and development of the agro-industrial complex” in terms of the development and implementation of technologies in 2020-2022, UAH thousand

Program levels	In total			NAAS		
	2020	2021	2022	2020	2021	2022
4.1. production, preservation, and processing of high-quality plant products	92 916.04	106 501.97	81 519.82	87 437.00	102 059.93	67 435.82
4.2. adaptive soil conservation agriculture	34 034.69	40 765.32	25 922.33	3 315 600	19.07	25 583.63
4.3. the latest biotechnologies in plant breeding, animal husbandry and veterinary medicine	16 373.20	18 882.00	12 463.82	16 124.00	18 863.30	12 463.82
4.4. production of livestock and pig breeding products	13 091.57	15 087.37	99.66	12 701.00	14 892.03	9 839.86
4.5. creation of highly productive alternative sources for obtaining fuel	4 671.00	5 535.3	3 542.35	4 671.00	5 361.03	3 542.35
4.6. production of diagnostic kits for animal diseases and means of their protection	5 203.0	6 089.354	7 036.04	5 100.00	5 956.36	3 935.94
4.7. production of diagnostics of plant diseases	2 348.10	2 286.81	1 443.8	1 905.00	2 183.88	1 443.18
All according to medium-term priorities	168 638.3	195 148.5	141 854.4	16 109 400	188 035.6	124 244.6
All according to strategic priority	184 048.11	209 802.9	150 406.2	170 100.0	198 560.6	131 198.1

Notes: NAAS – National Academy of Agrarian Sciences of Ukraine
Source: data by T.V. Pisarenko *et al.* (2023)

The share of agriculture in total funding amounts to more than half (56.3%), which, according to the findings of T.V. Pisarenko *et al.* (2023), indicates the preservation of the agricultural sector’s leadership among strategic priorities despite the slowdown in innovative activity. Funding is primarily provided by the funds of the National Academy of Agrarian Sciences (90.5%), as well as the Ministry of Education and Science of Ukraine.

Expenditures on research work in the field of economic sciences related to agricultural sciences during the period 2018-2023 averaged 1,400 million UAH per year. According to the Analytical Report “Implementation of Priority Directions in Science and Technology Development and Achieved Results in 2022” (Ministry of Education, 2023; Pisarenko *et al.*, 2023), government expenditures are the main source of funding, accounting for over 80% of the

funds. During the analysed period of 2018-2022, the funding structure was distributed as 84% state funds and 16% corporate or other sources. The lack of reporting on the innovation activities of industry enterprises does not allow for a more accurate tracking of the data proportion.

Law of Ukraine No. 2710-IX (2022, November) extends the previously active programs 2801050 “Scientific and scientific-technical activities in the development of the agro-industrial complex, standardization, and certification of agricultural products,” 2801130 “Qualification enhancement of specialists in the agro-industrial complex.” Funding for the scientific, technical, and educational components of agricultural programs from the State Budget for 2018-2023 and their share in the expenditures of the Ministry of Agrarian Policy and Food and in expenditures on science by economic sectors is presented in Table 4.

Table 4. Financing of the scientific, technical and educational component of agricultural programs of the State Budget in 2018-2023, UAH million

Programs	2023*	2022	2021	2020	2018
By functional classification					
Fundamental and applied research and development in the field of agriculture	1 956	2 006	1 483	823	1 367
Share in economics research, %	92.9	93.0	92.5	88.9	93.5

Table 4, Continued

Programs	2023*	2022	2021	2020	2018	
By program classification						
MAPF apparatus	1 475	1 539	2 053	5 106	4 031	4 668
280105 Scientific and scientific and technical activity	112	126	110	151	161	186
2801130 Advanced training	30	36	27	28	23	22
Share of expenditures on science, education, %	9.63	8.57	6.67	3.50	4.56	4.45

Notes: * – planned indicators: plan/adjustment as of September 1, 2023

Source: Ministry of Finance (2023)

The scientific and educational expenses of the Ministry of Agrarian Policy and Food (MAPF) from 2018 to 2023 decreased by 22% in terms of funds, while their share in the agrarian budget increased from 4.45% in 2018 to 8.57% in 2023. This indicates a formal nature of funding and the actual cessation of state support. In particular, even in the initial version of the State Budget for 2023, expenditures for agricultural science and education were budgeted at 9.63%, but as of September 1, 2023, it was adjusted to 8.57%. The opportunities for budget financing of scientific and technical activities in the agricultural sector through MAPF programs are practically non-existent.

Assessing the potential for financing the innovative development of Ukraine's agricultural sector in the conditions of economic digitalization involves considering the financial resources that the sector can attract for innovation and innovative activities from corporations. In the current situation of a state of war and critical shortage of financial resources, financing from internal sources will be even more limited, as activities with zero profitability are considered successful. However, experts suggest that developed countries create favourable conditions for business investment in innovation using indirect tools such as deducting investments from the tax base, preferential tax rates and "tax holidays," credits and grants, accelerated depreciation of assets, exemptions from infrastructure fees and land rent, insurance of innovative exports, government procurement of innovations, and more (Pyvovarov, 2018).

Therefore, the problems of financing essentially boil down to the search for resources depending on their cost. Currently, the state and financial market of Ukraine lack sufficient instruments to support agro-innovations. More realistic sources are funds from Ukraine's foreign partners and international funds for partnership support. However, disruptions in domestic and external logistics of agricultural product distribution and the forced preference for certain channels, such as the so-called "grain corridor," do not encourage support for domestic farmers by simultaneously weakening the competitiveness of investor countries.

An analysis of the multitude of factors in innovative activities allowed the formulation of their main criteria, sources of funding, and peculiarities of implementation during a state of war. To complement the findings, it is advisable to analyse the recommendations of other researchers and identify conflicting aspects of the issue of financing agricultural innovations. R. Birner et al. (2020) provide a

classification of some financing business models and note that digital services (as part of innovation) can be provided to farmers, traders, and consumers for free or for a fee, through mobile network operators, donors, suppliers, and the government. Accordingly, the sustainability of financing will have variations: variable, relying on (un)stable support from network providers; reliable, if participants can obtain lower service costs than the regular price and ensure higher product quality. Here, it is crucial to ensure that marketing and data collection benefits outweigh the costs of providing them.

L. Hrustek (2020) established that the advantages of applying digital technologies, big data and analytics, the Internet of Things, artificial intelligence and machine learning, blockchain, and Cyber-F, along with improved business forms supported by digital technologies, contribute to achieving business goals, saving time and money, flexibility, and efficiency of business processes. For agriculture, the development of new advanced digital solutions is expected to adapt risk management to preserve biodiversity and environmental protection, ensure an adequate supply of quality food products, harmonize all economic, environmental, and social development goals of society. In turn, research by T. Sus et al. (2023) indicates that the collaboration of innovation market actors on a mutually beneficial basis will contribute to the implementation of the innovation development strategy of the agricultural sector, increase the competitiveness of agricultural products with high added value in international markets, and increase the export of science-intensive products and technologies.

Experts (What five areas for startups..., 2022) point out the sectors in which Ukrainian startups will have the highest demand for innovations: defence and cybersecurity, construction and infrastructure, healthcare and medicine, educational projects, the agricultural sector, and green technologies. Investors show particular interest in the agricultural sector, where technologies such as artificial intelligence, biotechnology, cloud solutions, big data analysis, and drones are applied. This also creates unique opportunities for "product startups" (FoodTech) that can occupy a more significant position in the Ukrainian IT market, which was previously mainly service-oriented and outsourcing. There is a growing demand for technologies for agriculture and "green" startups aimed at environmental conservation and combating climate change. These technologies contribute to the more efficient operation of the agricultural sector and sustainable development.

Therefore, in the scientific-expert environment, an expanded approach has been formed to assess the role and need for comprehensive funding of innovations, focusing on the needs of the entire ecosystem, including farmers, processors, resource producers, providers of financial services to the population, and governments. In such conditions, the resource will not be just data but newly created advanced algorithms and knowledge through which the management of agricultural processes will be concentrated on climate change and global warming in response to sharp weather changes and other disruptions in the economy. If the state supports this investor interest through fiscal methods, it can become one of the main sources of innovation funding. The essence of applying the approaches of global agricultural practice to innovation financing, considering the business resource, lies in the possibility and necessity of aligning competitive conditions for economic activities and preventing a monopoly on access to digital (and financial) resources. This allows complementing the formulated provisions regarding the sources of financing agricultural innovations in the conditions of the digital economy.

Thus, the discussion is implemented in a series of recommendations that complement the above based on the conducted analysis. Such an approach allows generalizing and expanding the already known list of sources of funding for researchers' developments (Pyvovarov, 2018; Sus *et al.*, 2023) and systematizing them by components:

- Self-financing through refinancing profits into innovative projects and products.
- State support as direct financing of science, research, development, and production from the budget and government-attracted foreign investments.

- Grant funding through attracting funds from domestic and foreign donors, participating in international and cross-border cooperation programs.
- Targeted loans in the form of credits from commercial banks, bond loans, leasing, factoring.
- Financial cooperation as financing based on the cooperation of finances and resources of various corporations: cooperative unions, all economic forms on the principles of mutual assistance.
- Innovative financing through crowdfunding, venture financing, listing shares on stock exchanges, etc.

The combination of these source options in the conditions of network interaction shows the advantages of financing within the financial cluster, as indicated by (Zarichna, 2021). This is important because the challenges of the time require equivalent measures for the development of the digital economy and the search for sources of its financing. Given the disruptions experienced by the agricultural sector and its logistics, post-war recovery is possible precisely through targeted efforts of the government, international partners of Ukraine, and agricultural corporations for innovative development based on the best global scenarios adapted to national needs for ensuring and guaranteeing food security. Now, researchers recommend forming clusters based on production and financial characteristics (Kovalenko *et al.*, 2023).

The scheme of the mechanism of the financial cluster for the needs of financing agricultural innovation development is presented in Figure 3. The mechanism of such a cluster is essentially institutional, connecting economic and social components and manifesting itself at the level of the state, financial market, sectors of the economy, agricultural corporations, and investors.

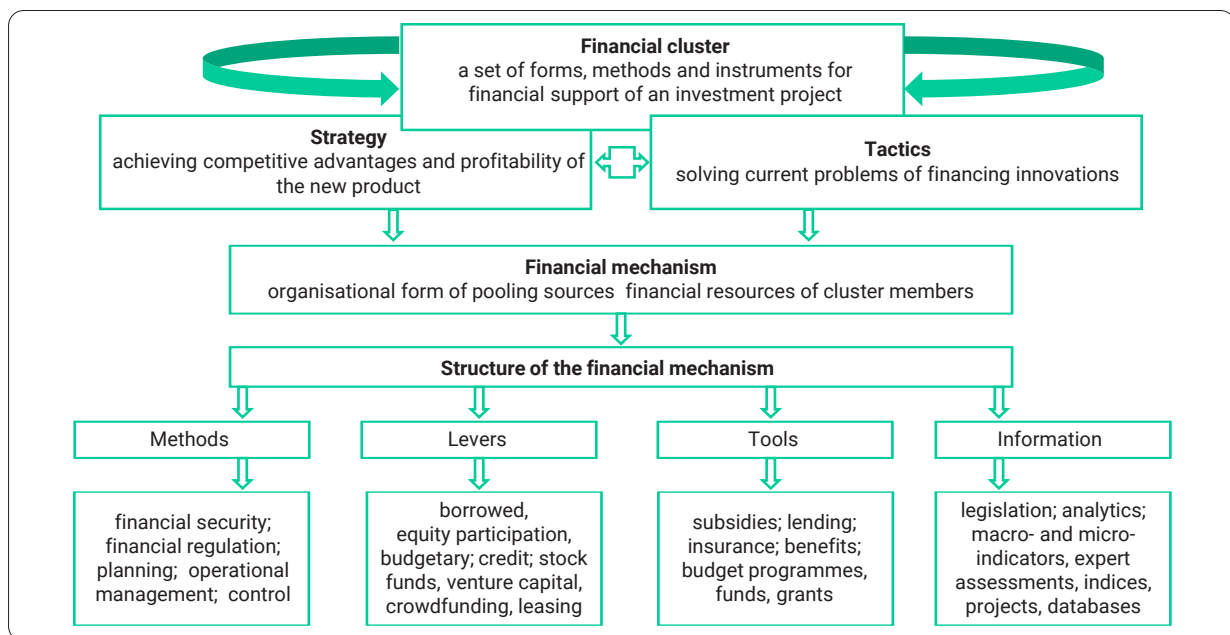


Figure 3. Scheme of the mechanism of the financial cluster of agrarian innovative development of Ukrainian ranches of the economy of Ukraine for 2014-2022, UAH million, %

Source: developed by the authors based on N.Z. Zarichna (2021); T. Sus *et al.* (2023)

Therefore, considering the entire spectrum of problems discussed in the directions, it is to be noted that the optimal form of financing the innovative development of the agricultural sector at the present time is the consolidation of actors in the innovation market into a financial cluster. It will play the role of generating and implementing forms, methods, and instruments of financial support for the implementation of an investment project for the benefit of all participants and the multiplier effect on the sustainable development of agriculture. The cluster's mechanism of action involves a set of organizational, regulatory, and managerial measures to support the balance of financial resources of corporations and the industry to optimize financial flows (redistribution of financial resources) for the needs of innovation and/or innovative activities. Such a financial cluster is realized within the financial market and has methods and levers corresponding to the current regulatory framework. The special product of the financial cluster is its characteristic financial instruments, which depend on the contours of the form or method of the contract/agreement used to attract financial resources. This allows the government and entities in the agricultural sector to expand sources of investment with mutual benefit and to control market providers, preventing them from having the right to monopolize the provision of financial resources for digital technologies exclusively in a consumer-oriented context.

Conclusions

This study demonstrates that innovative development in the agricultural sector is crucial for overcoming destructive trends in the conditions of war and post-war recovery. The issue of finding relevant sources of funding is particularly relevant. The Global Innovation Index for Ukraine from 2014 to 2022 fluctuates over the years, but has changed very insignificantly, from 63 to 57, although there is a moderate trend towards strengthening positions, especially in components such as human capital, business environment, knowledge, and quantitative research results (Krykova et al., 2021). It is likely that to overcome the economic decline during periods of armed conflict, it is necessary to boost innovative activities to the level of countries that have experienced armed conflicts and successfully recovered from devastation.

The dynamics of GDP volumes and the share of individual sectors in Ukraine from 2014 to 2022 indicate that the decline in the GDP of the agricultural sector is deeper than that of the digital sector, 28% compared to 7%. Probably, increasing the share of digital services in the formation of agricultural GDP will contribute to sustainable growth. Since the decline in the volumes of the agricultural sector in the wartime of 2022 compared to 2021 was, If the pre-war level of government spending on financing agricultural innovations in terms of their development and dissemination accounted for about 80.2% of research funding in the

economy, which is clearly insufficient for the simple reproduction of the formation of scientific products, then even the preserved 92.8% funding for budget expenditures on scientific research during the wartime will not produce the expected effect. Evidence of this is also the fact that the share of MAPF expenditures on science and education has decreased by 22% over the past 6 years, although by structure, it has increased from 4.45% in 2018 to 8.57% in 2023, which is explained by the reduction in overall financing of the agricultural sector by 67% during this period.

An assessment of the state of financing in the agricultural sector aimed at enhancing innovative processes in the post-war period has been carried out. This assessment is based on a systemic approach to the formation of financial resources for the implementation of innovations. A dependency on the growth of the agricultural GDP from several factors has been identified based on correlation and variance analysis. The correlation results show the highest impact from the growth of the ICT share in the economic structure, followed by profitability, tax incentives, financing, and budgetary support, which has almost no influence due to minimal amounts. The possibility of measuring the impact of innovations on the GDP of the agricultural sector contributes to the selection of effective management decisions in prioritizing the financing of innovative development.

It has been established that financing the agricultural sector to promote innovative processes during periods of crisis should be based on a systemic approach. This approach is rooted in a financial cluster mechanism that considers the interests of all participants in the process. The variability of financing depends on the possibilities of implementing digital directions in the production and operational activities of farmers, filling the state budget, and generating international aid or financing. The sources of financing depend on the chosen agricultural policy, but most remain traditional: self-financing, state support, grant funding, targeted loans, financial cooperation, innovative financing, and so on. Importantly, the criterion for agricultural investment should be societal interest in achieving sustainable development goals, environmental friendliness of activities, cost reduction of production factors, and improvement of the quality of financial and human capital.

Further research directions include addressing issues related to the diversification of financial support for innovative development to effectively choose sources of financial resources for implementing innovative processes in the agricultural sector.

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Conflict of Interest

None.

References

- [1] Basso, B., & Antle, J. (2020). Digital agriculture to design sustainable agricultural systems. *Nature Sustainability*, 3, 254-256. doi: 10.1038/s41893-020-0510-0.

- [2] Birner, R., Daum, T., & Pray, C. (2021). Who drives the digital revolution in agriculture? A review of supply-side trends, players, and challenges. *Applied Economic Perspectives and Policy*, 43(4), 1260-1285. doi: 10.1002/aep.13145.
- [3] Den Hertog, P., & Bilderbeek, R. (2001). [The new knowledge infrastructure: The role of technology-based knowledge-intensive business services in national innovation systems](#). In *Services and the knowledge-based economy* (pp. 222-246). London: Routledge.
- [4] Dorosh-Kizym, M., Dadak, O., & Gachek, T. (2017). Innovations in the agricultural sector of Ukraine in the context of the development of European integration. *Scientific Messenger LNUVMB*, 19(81), 123-128. doi: 10.15421/nvlvet8122.
- [5] Enabling the Business of Agriculture. (2019). Retrieved from <https://openknowledge.worldbank.org/server/api/core/bitstreams/9cd7105f-e1c2-52ee-ad27-a63d983a2d2f/content>.
- [6] Global Innovation Index (GII). (2023). Retrieved from https://www.wipo.int/global_innovation_index/en/.
- [7] Holysheva, Ye. (2021). Innovative marketing tools for increasing the competitiveness of agricultural enterprises. *Economy and Society*, 32. doi: 10.32782/2524-0072/2021-32-76.
- [8] Honcharenko, O., Samilyk, T., & Teslyuk, Yu. (2019). Institutional determinants of innovation development in agricultural production. *Efficient Economy*, 12. doi: 10.32702/2307-2105-2019.12.16.
- [9] Hrustek, L. (2020). Sustainability driven by agriculture through digital transformation. *Sustainability*, 12(20), article number 8596. doi: 10.3390/su12208596.
- [10] Institute of Intellectual Property. (2023). Retrieved from <http://iii.ua/ru/news/ukrayina-v-globalnih-innovatsiyah-ievropeyske-innovatsiyne-tablo>.
- [11] Kovalenko, V., Sheludko, S., Semenova, V., Kotsiurbenko, G., & Danylina, S. (2023). Credit and Investment support for the development of Ukraine's agricultural and economy sector. *Scientific Horizons*, 26(5), 151-163. doi: 10.48077/scihor5.2023.151.
- [12] Lajoie-O'Malley, A., Bronson, K., van der Burg, S., & Klerkx, L. (2020). The future(s) of digital agriculture and sustainable food systems: An analysis of high-level policy documents. *Ecosystem Services*, 45, article number 101183. doi: 10.1016/j.ecoser.2020.101183.
- [13] Law of Ukraine No. 1667-IX "On Stimulating the Development of the Digital Economy in Ukraine". (2021, July). Retrieved from <https://zakon.rada.gov.ua/laws/show/1667-20#Text>.
- [14] Law of Ukraine No. 3715-VI "On Priority Areas of Innovation Activity in Ukraine". (2011, September). Retrieved from <https://zakon.rada.gov.ua/laws/show/3715-17#Text>.
- [15] Law of Ukraine No. 40-IV "On Innovation Activity". (2002, July). Retrieved from <https://zakon.rada.gov.ua/laws/show/40-15#Text>.
- [16] Law of Ukraine No. 2710-IX "On the State Budget of Ukraine for 2023". (2022, November). Retrieved from <https://zakon.rada.gov.ua/laws/show/2710-20#Text>.
- [17] Maslak, O.I., Danylko, V.K., Grishko, N.Ye., & Skrypniuk, K.O. (2020). Knowledge economy: Evolution of scientific ideas, components and factors of formation in the newest conditions. *Efficient Economy*, 12. doi: 10.32702/2307-2105-2020.12.17.
- [18] Ministry of Agrarian Policy and Food of Ukraine. (2023). Retrieved from <https://minagro.gov.ua/napryamki/agrarna-nauka-ta-osvita/pidtrimka-agrarnoyi-nauki-ta-osviti>.
- [19] Ministry of Education and Science of Ukraine. (2023). Retrieved from <https://mon.gov.ua/ru/tag/doslidzhennya-ta-innovatsii>.
- [20] Ministry of Finance of Ukraine. (2023). Retrieved from <https://openbudget.gov.ua/>.
- [21] Order of the Cabinet of Ministers of Ukraine No.526 "The Strategy for the Development of the Sphere of Innovative Activity for the Period until 2030". (2019, July) Retrieved from <https://zakon.rada.gov.ua/go/526-2019-%D1%80>.
- [22] Osetskiy, V.L., & Kulish, V.A. (2020). Innovative industrialization in the agro-industrial complex of Ukraine. *Ekonomika APK*, 27(4), 54-65. doi: 10.32317/2221-1055.202004054.
- [23] Pisarenko, T.V., Kvasha, T.K., Rozhkova, L.V., Paladchenko, O.F., Molchanova, I.V., & Berezniak, N.V. (2023). *Implementation of medium-term priority areas of innovation activity at the national level in 2022: Analytical report*. Retrieved from <https://mon.gov.ua/storage/app/media/innovatsii-transfer-tehnologiy/2019/07/03/stan-innov-diyaln-2018f.pdf>.
- [24] Pyvovarov, Yu. (2018). *Eight state incentives for the development of innovation*. Retrieved from <https://biz.nv.ua/rus/experts/visim-derzhavnikh-stimuliv-dlja-rozvitku-innovatsij-2471552.html>.
- [25] Radchenko, O. (2023). State management and financial support of innovations: The example of Ukraine. *Public Policy and Accounting*, 1(7), 22-40. doi: 10.26642/ppa-2023-1(7)-22-40.
- [26] Resolution of the Cabinet of Ministers of Ukraine No. 1056 "Some Issues of Determining Medium-Term Priority Areas of Innovation Activity at the National Level for 2017-2021". (2016, December). Retrieved from <https://zakon.rada.gov.ua/laws/show/1056-2016-D0%BF#Text>.
- [27] Resolution of the Cabinet of Ministers of Ukraine No. 13 "On Approval of the Procedure for the Formation of Topics for Scientific Research and Scientific and Technical (Experimental) Developments Financed from the State Budget". (2018, January). Retrieved from <https://zakon.rada.gov.ua/go/13-2018-%D0%BF>.
- [28] Roieva, O., Oneshko, S., Sulima, N., Saienko, V., & Makurin, A. (2023). Identification of digitalization as a direction of innovative development of a modern enterprise. *Financial and Credit Activity Problems of Theory and Practice*, 1(48), 312-325. doi: 10.55643/fcaptive.1.48.2023.3968.

- [29] Shpak, Yu.V., & Fedorchuk, O.M. (2021). [Formation of software innovative packages for agro-industrial development](#). *The Scientific Heritage*, 4(68), 36-42.
- [30] State Statistics Service of Ukraine. (2023). Retrieved from <https://stat.gov.ua/en/datasets>.
- [31] Sus, T., Suduk, N., Yemets, O., Movchun, S., & Tsiupa, O. (2020). Innovative development of the agricultural sector: Financing models and assessment of the impact of financing at the regional level. *Financial and Credit Activity Problems of Theory and Practice*, 2(49), 181-193. doi: 10.55643/fcftp.2.49.2023.4021.
- [32] Tkach, L.L., & Dendebera, O.P. (2023). Innovative nature of the knowledge economy. In *The IV All-Ukrainian scientific and practical internet conference "Development of financial and credit systems: Today's challenges"* (pp. 66-68). Uman: NUS.
- [33] What five areas for startups will be in demand in Ukraine after the war. (2022). Retrieved from <https://dia.dp.gov.ua/yaki-pyat-napryamkiv-dlya-startapiv-budut-zatrebuvani-v-ukra%D1%97ni-pislya-vijni>.
- [34] Zarichna, N.Z. (2021). Mechanism of financial and economic support for the functioning of financial clusters. *Eastern Europe: Economics, Business and Management*, 31, 106-111. doi: 10.32782/easterneurope.31-1.

Фінансування інновацій аграрної галузі як складової цифрового розвитку економіки України

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Анотація. Інноваційний розвиток економіки є умовою стабільного зростання, що для аграрної сфери має особливе значення, виводячи управління біологічними активами на суттєво вищий рівень. Мета роботи полягає у визначенні потенціалу інноваційного розвитку аграрної галузі України та дослідженні особливостей її фінансування. Застосовано загальнонаукові методи, герменевтичний метод; статистичний і кореляційний для виявлення зв'язку факторів впливу; табличний та графічний для презентації результатів; узагальнення для висновків. Оцінено позиції України за Глобальним Індексом Інновацій (2014-2022 рр.) який досить низький і знизився за період з 63 до 57, але має потенціал за складовими людського капіталу, бізнес середовища, наукових досліджень. Виявлено залежність зростання обсягів аграрного ВВП від ряду факторів на основі кореляційного та дисперсійного аналізу, зокрема й за рахунок нарощування інновацій. Структура динаміки ВВП показує спад аграрної галузі у воєнному 2022 році проти 2021 року на 28 %, а інформаційно-телекомунікаційної галузі – лише на 7 %. Якщо довоєнний рівень державних видатків на фінансування аграрних інновацій сягав 80 % загальноекономічних, що забезпечувало лише відтворення умов формування наукоємної продукції, то навіть підвищення його до 90 % у період воєнного стану не покриває реальних потреб. Науково-освітні видатки Міністерства аграрної політики і продовольства у 2018-2023 рр. за обсягом коштів знизились на 22 % за період, а їх частка зросла з 4,45 % у 2018 році до 8,57 % у 2023 році, через падіння загального рівня фінансування на 67 %. На підставі оцінки стану фінансування інновацій аграрної галузі з метою їх нарощування запропоновано системний підхід до вибору джерел фінансування. Побудовано оптимальну схему фінансування аграрних інновацій за консолідованими джерелами за умов формування фінансового кластеру. Практичне значення дослідження полягає у можливості використання його результатів при розробці стратегії поствоєнного відновлення аграрної галузі в частині оцінювання ефективності моделей фінансового забезпечення інноваційного розвитку

Ключові слова: джерела фінансування; наукове забезпечення; бюджет; цифровізація; фінансовий кластер

Modelling decision-making in the field of green production in a post-industrial society

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Abstract. Modern management processes must solve the complex problem of optimal decision-making and timely and effective forecasting of their results, to select successful combinations of solutions in a particular production area of the new information and innovation society that has replaced the industrial era. Considering the above issues, the modelling process as an effective mechanism for decision-making and risk management deserves special attention. The purpose of the study was to highlight modelling as an effective method of decision-making in green production in a post-industrial society, and to justify the feasibility of its use at different levels of the production process. During the study, theoretical methods were applied, in particular, the study of scientific materials and research results, description and comparison. The results were also generalized and analysed. The article considers main approaches to the strategy of the introduction of modelling of decision-making in the field of green production in the post-industrial society, and provides a detailed definition of its structural elements and priority principles. It is clarified that modelling as a management tool is used in the development of rather complex production and management decisions and is the construction of a model or system of models of the process or phenomenon under study for its study, analysis, and formation of an appropriate fan of alternatives to the result. The main types of modelling according to different classifications are analysed, and the possibilities of applying some of them in the decision-making system in the production plane are investigated. Conclusions on the efficiency and effectiveness of the use of the modern innovation and information economic space in production processes are provided. The expediency of using different approaches to decision-making modelling, depending on some influencing factors, is substantiated. The possibility of solving the industrial multitasking of decision-making by creating models is proved. These research results are of practical importance for improving management processes in the field of green production in a post-industrial society, regardless of ownership, production volumes and scope of activity

Keywords: innovation; system model; green economy; alternative solutions; production process

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Introduction

Modern economic and production processes are faced with the acute problem of limited and exhaustible resources on the one hand, and the growing burden on the environment on the other. The post-industrial society, characterized by a shift from the predominant production of goods to the priority of the service sector, with the primary influence of information and intellectual technologies, sets its own requirements for the production process. The production system is acquiring “green” characteristics based on the principles of energy efficiency, minimization of negative impact on the environment and innovation. Intellectual assets, highly skilled labour, and the ability to come up with and implement ideas are becoming productive forces in a post-industrial society (Radziszewska-Zielina *et al.*, 2022). Sustainable innovation development and the “proactive movement” inherent in green manufacturing require a fundamentally new approach to decision-making – more flexible, adaptive, but at the same time with clearly defined structural algorithms and an orderly hierarchy of priorities.

One of the most optimal tools in the decision-making system in the production activities of a post-industrial society is modelling, a special way of reflecting objective reality, in which a specially created model is used to study the system with the reproduction of the essential properties of the phenomenon or process under study (Kuzmin *et al.*, 2021; Hurzhyi *et al.*, 2022). Modelling makes it possible to make reliable predictions of real systems and effectively optimize their operation (Zhang *et al.*, 2020; Han & Xia, 2021). Depending on the goals set, models are developed and applied to make decisions in various areas of production management. In particular, the management of the production logistics system, planning of production activities, management of the sales system, etc. The specifics of model creation are primarily determined by the choice of appropriate performance criteria and procedures for implementing the modelling results. The goal of the modelling process is to prepare and adopt the most successful solution to a particular problem, considering the maximum possible variability of preconditions and influencing factors. Since the decision-making process in the manufacturing sector is usually accompanied by a limited amount of information, modelling allows successful decisions to be made without taking this limitation into account (González-Prida & Carnero, 2021). Modelling is becoming particularly relevant for decision-making in the field of green production, as it makes it possible to consider the priorities and features of the latter in the decision-making process, shifting the focus from standard algorithms to optimally structured flexible models.

The problem of decision-making in a sustainable economy of a post-industrial society is covered in the works of many scholars and leaves a lot of room for finding optimal solutions. Modelling of decision-making is considered in the works of modern scientists R.X. Ding (2020), M. Mahrinasari *et al.* (2021). Their research is aimed at establishing modelling as an effective decision-making tool

in modern production processes, considering the basic principles of circular economy development and the innovative direction of post-industrial society. Ways to improve and prevailing dominance of “green” processes in modern production, which are studied in detail in the works of S. Gershwin (2018), M. Goncharenko *et al.* (2020), N. Norouzi (2021), include the introduction of advanced decision-making methods and correlation of situational production changes with the help of an accessible and effective tool, primarily modelling, as an integral part of management processes. The need to apply modelling to decision-making in the production processes of the green economy is due to the complexity of organizational situations, the impossibility of experimenting with real objects and the orientation of management processes towards the future with mandatory analysis of the consequences of certain alternatives. The purpose of the study was to examine modelling as an optimal tool for successful production decision-making in the green economy of a post-industrial society, as well as the necessary prerequisites for its practical implementation at different stages of production processes and to compare the main approaches to model building, with the most optimal and universal options being identified.

Materials and Methods

The study used the analysis method to reveal the theoretical aspects of modelling as a decision-making tool in production activities. Also, based on this method, its classification types and main approaches that are optimal for practical use in the management processes of a post-industrial society were characterized. The analysis was necessary for studying the features of green production as an integral part of the development of post-industrial society. In the course of using this method, the essence of the principles of the circular economy and the environmental orientation of the modern production and economic system was revealed. By means of analysis and synthesis of information volumes and scientific works in the field of the studied issues, as well as by means of the comparison method, the weaknesses of the object of study, the priority vectors of further detailed research are identified, and the effectiveness of modelling as the dominant approach to decision-making in the field of green production is assessed.

To determine the effectiveness, advantages, and features of the process of modelling decision-making in green production in a post-industrial society, a systematic approach is used, which focuses the research on revealing the integrity of the object of study and the mechanisms that ensure it. Particular attention is paid to the variability of approaches to the modelling process, its flexibility, focus on development and improvement. In the course of the study, theoretical methods of scientific research were used. In addition, the study has formed its own model of optimization of green production in a post-industrial society, the implementation of which can effectively affect the activities of Ukrainian enterprises in the field of green production.

Accordingly, its purpose, tasks, structure, stages, as well as advantages and disadvantages were revealed. The developed model in the study can be adapted to any specific production conditions and goals set for the enterprise.

In the course of the study, the author conducted relevant analytics and determined the level of priority of certain types of models in terms of the efficiency of decision-making in production and management activities. Within the framework of the deterministic approach, the study revealed the prerequisites and determining factors for choosing the optimal type of models used. The method of comparison was used in the study to compare the general principles and those inherent in most of the decision-making models. It was used to establish a list of principles that can form the basis for the successful implementation of a modelling system in green economy production processes. The comparison was also necessary to compare different approaches to decision modelling in order to identify their advantages and disadvantages.

Based on the comparative and descriptive method, the study expressed the specifics of the properties of the modelling object, as well as its classification types. The descriptive approach was necessary to reveal the best options for modelling schemes used in decision-making directly in the field of green production of post-industrial society. The method of generalization was necessary to study and identify typical features and properties of the phenomenon under study. On its basis, the regularities of the phenomenon under study, its opportunities, and problems in the conditions of post-industrial society were expressed. This method made it possible to determine the list of factors that cause difficulties in the process of implementing the approach of creating decision-making models in production processes.

Using the deduction method, the specific principles of successful use of the modelling process were revealed, based on an understanding of general approaches to effective decision-making. It was necessary to implement a differentiated approach in the study, as well as to determine its specific orientation towards the innovation and information path of production development in a post-industrial society.

Results

In the process of studying the phenomenon of decision-making modelling and its theoretical implementation in management processes in the field of green production in a post-industrial society, some features, differences, and specific factors have been identified that affect both the general decision-making process and the nuances of implementing the results of the decision in a problematic production situation.

The process of choosing the best of several possible courses of action to achieve a certain goal is called decision-making. Modelling is an effective tool for justifying and selecting management decisions. Models are the basis of a scientific approach to decision-making. O. Kushlyk-Dyvulska & B. Kushlyk (2014) note that a model is a simplified representation of an object, system, or idea that

differs from the real world. Modelling is used in theoretical and experimental research methods, the only difference is in the types of models used.

Decision-making models should reflect the key elements of this process: goals, possible options, environmental conditions, and functions that determine the success of the chosen decision. Models can perform both one and several objective functions, i.e. the value underlying the assessment. In addition to the objective function, a prerequisite for successful modelling is the existence of priorities for the ratio, which represent the relative efficiency of achieving the objective functions. The second element is a set of alternatives, i.e. expected courses of action. In software decision models, several options can be implemented simultaneously. The third element is the state of the external environment, a set of external factors of influence and their predicted development. There are situations of certainty, uncertainty, and risk. The model provides different levels of information support for different states. The effectiveness function allows predicting the consequences of a certain alternative in a given state of the environment. At the same time, consequences of an unambiguous nature can only be inherent in combinations that include an alternative and a state of certainty, while in a situation of uncertainty or risk, several options for consequences are possible simultaneously. The time factor, which is clearly manifested in decision-making models and is a priority in determining the periods and timing of actions, should not be neglected. Thus, models can be both static and dynamic. The effectiveness of modelling is determined by a number of factors specific to production processes:

- the complexity of production and organizational situations in relation to a particular issue;
- impossibility of conducting an experiment in most situational circumstances;
- the future orientation of production activities, which makes it impossible to study a phenomenon that does not yet exist and may never occur.

In such a situation, modelling is positioned as the best way to see the options for the future and determine the potential consequences of alternative solutions, which makes it possible to compare them objectively. At the same time, there are options for studying the interrelationships and interdependencies of the modelled system and improving its further functioning and development. If the simplification of a real production system is carried out correctly, the approximate reflection of the real situation obtained as a result allows forming rather accurate characteristics and properties of the object of study.

Among the advantages of decision-making modelling as an effective tool are the following

- the possibility of applying a systematic approach to analysing a situation or problem;
- obtaining a wide variety of alternatives as a result of modelling;
- the possibility of involving data from the lowest levels of management;

- less resource and time consumption compared to conducting experiments with real production systems;
- identification of factors of minimal impact on the problem in the process of modelling and their subsequent limitation.

Among the main properties of models in general, it is worth noting that the model should be similar to the object under study, but at the same time should be simpler so that it can be studied. At the same time, the main purpose of the model is to allow for experiments, analysis, and study that are not possible with the object under study. The creation of a model is the development of a formalized scheme, which includes the establishment of the purpose of modelling, the accumulation of input information from a list of sources, which is subject to further processing and makes it possible to create a modelling result – decision options, and sometimes even alternative ways of solving a problem or situation. Identification of the advantages of a situational solution or goal, as well as the formation of an optimal selection criterion in the modelling process, makes it possible to eliminate a problematic situation or obstacle or make another correct decision. Developing an algorithm for choosing such a solution through certain possible actions ensures that the production goal is best achieved. Model validation involves checking whether the built model matches the real

situation. For this purpose, information based on experience or analogies with decisions already made and implemented is used. It is worth noting that for decision-making in the field of production, including green production, it is most appropriate to use models with clear regulations. They rationalize the development of an action strategy in terms of pre-identified constraints and criteria, taking into account the most reasoned positions. Such models have some specific features:

- the system parameters should cover the characteristics and peculiarities of the place, time, and product of the problem;
- the information on which the essence of the problem situation is based must have a reliable assessment of the degree of completeness and reliability;
- the relevance, novelty, priority, and urgency of the problem are taken into account;
- all stakeholders in solving the problem are covered, as well as possible limitations that may be imposed by them at the stages of preparation and implementation of the solution;
- different types of decisions are applied – innovative, stochastic, deterministic, etc.

In the process of building a decision-making model in the field of green production, general stages can be identified (Fig. 1):

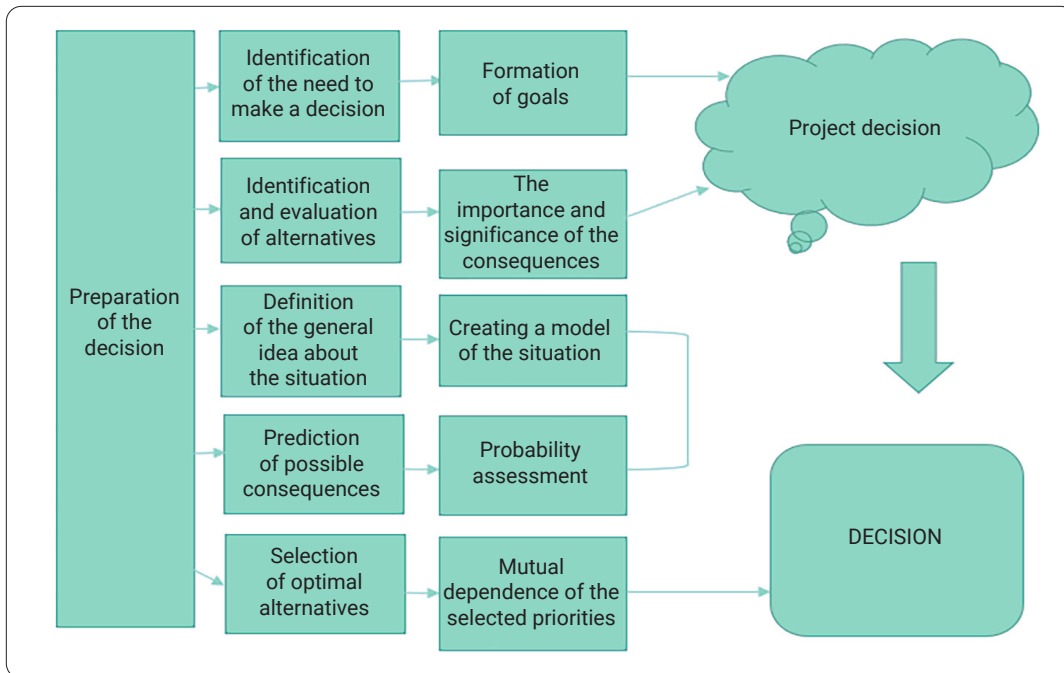


Figure 1. Modelling decision-making

Source: developed by the author

If considering the main conceptual models of decision-making in the field of green production in a post-industrial society, it is worth focusing on the feasibility of using some of them. In particular, the following can be identified as proposed for practical application:

- convergence model (special attention is paid to the impact of the production process on intra-group relations);
- descriptive model (used to determine the properties and parameters of the decision-making process for the purpose of long-term forecasting);

- adaptive (based on the introduction of new methods for a specific problematic decision-making situation);
- deterministic model (based on a clear formulation of goals, taking into account the factors of periodicity and complexity and with a clear fixation of the factors of influence at the time of decision-making and accurate predictability of their impact);
- stochastic model (involves an element of uncertainty and unpredictable impact on the development of the situation).

In addition, general approaches (models) to decision-making in the field of green production in a post-industrial society can be distinguished: the rational decision model, the intuitive model and the creative decision model.

Despite some generality inherent in the above classification, virtually all decisions in production processes, depending on the urgency, availability of resources, and nature of the problem, can be made by using one of these models.

The key is to focus on using the most logical solutions to find the best option. This process often involves analysing several solutions simultaneously. The rational decision model is a convenient approach if there are sufficient time resources (Fig. 2). The value of the model lies in the fact that it often results in rational decisions. In addition, the use of computer technology and minimization of the negative aspects of the human factor are given the highest priority for its creation.

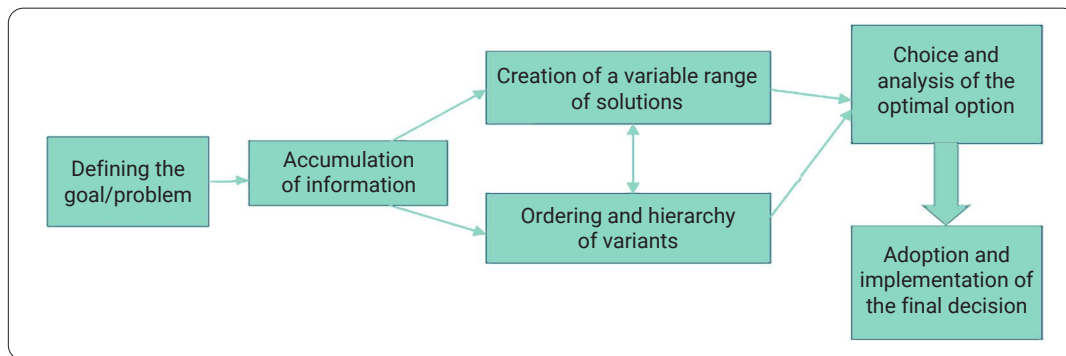


Figure 2. Model of making a rational decision

Source: developed by the author

It is characterized by the use of feelings and instincts to make decisions. Despite some ambiguity of this approach to production processes, it is justified in case of the need to make quick decisions or in extreme circumstances when logical justification is limited by the time factor. The intuitive decision-making process is less structured and is based mainly on experience and analogies. Intuitive decision-making relies more on personal experience and intuition than on consistent logic or concrete reasoning. Intuition is not arbitrary or irrational, as it is based on years of practice and common sense arguments accumulated in the subconscious mind. The use of intuition provides a quicker sense of the problem and a much faster choice of a solution. The main disadvantage of the intuitive decision-making model is that it does not reflect functional relationships and constraints, although it does provide the basis for building more complex models (Fig. 3).

The creative solution model is based on the use of non-standard approaches to make innovative decisions that allow achieving goals or overcoming obstacles. A special feature in this case is the search for solutions based on experience or analogy. The creative solution model is effective when situations arise that have not been encountered in the production process before, or when implementing new projects. Using this type of decision-making usually requires flexible thinking to create successful, unique solutions and is an integral part of the iterative processes that characterize post-industrial society. The use of various soft-

ware products and computer-graphic methods opens up opportunities to reduce time costs and minimize the impact of the human factor on the modelling result, if necessary, as well as to create a kind of decision archive that can serve as a starting point when using a creative decision model or a rational model. If an intuitive decision-making model is the priority, even a schematic hand drawing can be used.

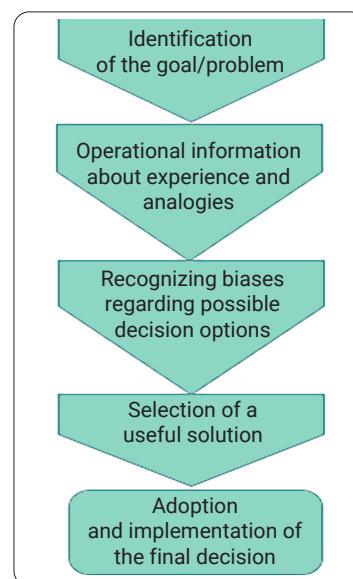


Figure 3. Intuitive decision-making model

Source: developed by the author

Based on the above, the study developed its own model of production optimization for green manufacturing in a post-industrial society. Its purpose is to ensure maximum efficiency of green production with minimal environmental impact. The objectives of this model are to optimize the production process, resource use, and waste management. As for the basic principles on which the model should be implemented, they include:

- energy efficiency – using the minimum amount of energy for production (introduction of energy-saving lamps in industrial workshops; use of energy-saving engines in transport; use of closed cooling circuits);
- use of renewable energy sources – use of energy from renewable sources (installation of solar panels at industrial enterprises; use of wind power plants for electricity generation; development of hydropower);
- use of resource-saving technologies – use of technologies that reduce the consumption of raw materials and

supplies (waterless technologies for cement production; use of recycled materials for paper production; reduction of waste per unit of production, for example, through the use of compact packaging);

- absence of harmful emissions – ensuring the absence of harmful emissions into the environment (introduction of waste-free technologies; installation of filters at industrial enterprises; reduction of chemicals use).

The structure of a production optimization model for green production in a post-industrial society consists of a database (containing information on the production process, resource characteristics, emissions, and waste); an optimization algorithm (determining the optimal production parameters). In this case, the latter is based on the method of mathematical programming and allows setting such values of production parameters that ensure maximum production efficiency with minimal environmental impact. The stages of the model are shown in Figure 4.

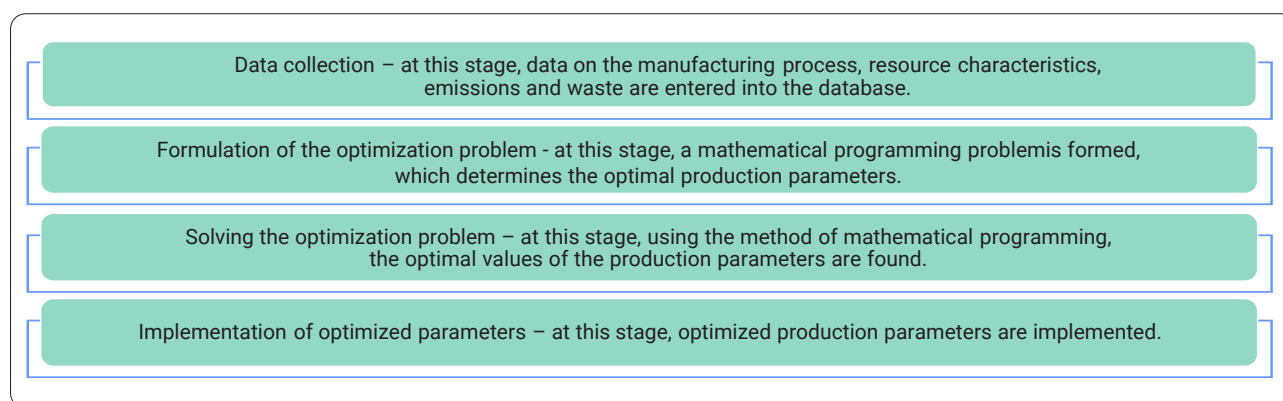


Figure 4. Stages of implementation of the optimization model of green production in a post-industrial society

Source: developed by the author

In a post-industrial society, where attention is paid to renewable energy sources and resource-saving technologies, the proposed green manufacturing optimization model can be used to reduce: dependence on fossil energy sources; consumption of raw materials and supplies; and emissions of harmful substances into the environment. For example, the model can be used to optimize the production of solar panels using renewable energy sources such as solar and wind power. This will help reduce greenhouse gas emissions and reduce dependence on fossil energy sources. In addition, the model can be used to optimize the production of solar cells using resource-saving technologies, such as zero-waste technologies. This will reduce the consumption of raw materials and reduce the amount of waste generated in the production process.

The advantages of the proposed model are as follows:

- it allows for maximum efficiency in the production of green products with minimal environmental impact;
- flexible and can be adapted to any type of green production;
- efficient and can be used to optimize the production of any volume of green products.

As for the disadvantages, they include:

- it requires a significant amount of data on the production process, resource characteristics, emissions, and waste;
- it can be difficult to understand and use.

Based on the above, it can be established that the production optimization model for green production in a post-industrial society is an effective tool that can be used to increase the efficiency of green production with minimal environmental impact. The studied variants of decision-making models in the field of green production recommend themselves as having the right to be applied in practice. The choice of the optimal way to apply them and their priority in each case depends on a number of factors, such as the nature of the problem, the specifics of the production process, the availability of information collection and processing systems, the level of efficiency required in decision-making, and the risks of the prolonged impact of the decision on production processes. However, each of the approaches can bring practical benefits in the decision-making process, while minimizing risks and creating alternatives to problematic decisions.

Discussion

Analysing the results of the study of modelling as a decision-making tool in green manufacturing in a post-industrial society, it is worth noting that many scientists and researchers consider the issue of its active implementation to be a prerequisite for the development of intelligent management of production processes in a post-industrial society (Käki *et al.*, 2019; Mahrinasari *et al.*, 2021). The green economy is characterized by the priority of an innovation and information approach to management processes, and somewhat deviates from the classical decision-making methods typical of an industrial society. The development of advanced technologies, the growing importance of the knowledge and creativity factor are at the forefront of society's modern movement into the future. This process requires a rethinking of approaches to the main levers of management, in particular, decision-making in the production sector. C. López Bello *et al.* (2014), T. Aliyev & Sh. Aliyeva (2022), C. Julmi (2019) believe that decision-making modelling allows not only avoiding gross mistakes in the options for solving a problem or situation, but also makes it possible to use intuition, which is undoubtedly a priority in solving extreme problematic situations. It is difficult to disagree with them, because modelling not only allows for decision-making based on both a rational and intuitive approach, but also involves creativity and critical thinking in the decision-making process.

It should be noted that those options for building decision-making models that are based on a clear structuring are more optimal when it is necessary to eliminate the ambiguity of the result. This is insisted on by E. Flores-Garcia *et al.* (2021). At the same time, in their opinion, the intuitive component of the process is also important, and only a competent proportion between the normative, intuitive, and mixed processes in each specific case of decision-making can ensure the proper effect of modelling and a high level of success of the adopted solution to a problem or situation. A similar opinion is shared by D.J. van der Zee (2006), M. Mahrinasari *et al.* (2021). V. González-Prida & M. Carnero (2021) consider it necessary to continuously improve modelling as a tool for effective decision-making, especially in conditions of uncertainty or increased risk. The scientists propose a comprehensive approach for an optimal and objective decision-making process, as this approach can guarantee an increase in the competitiveness of production, reduce risks, and eliminate uncertainty. The opinion of the author of the current study is consistent with the statements of scientists, since such an approach makes it possible to take into account various factors that influence decision-making, including economic, social and technological aspects.

Such an integrated approach helps to increase the competitiveness of production, reduce risks and effectively eliminate uncertainty, making it a key element in modern management. Competent knowledge management, effective production planning, focus on renewable resources and risk management are becoming a priority in the post-

industrial era. One of the obstacles that may arise on the way to the successful construction of a decision-making model may be the lack of integration and accumulation of the necessary information (Johansson & Winroth, 2010; Gigerenzer & Gaissmaier, 2011; Durbach & Montibeller, 2019). Despite the increased complexity of this aspect, scientists are currently actively developing methods for enriching analytical models with industry information to facilitate data analytics, in particular in smart manufacturing (Zhang *et al.*, 2020). Such modern high-tech research makes it possible to implement interoperability and traceability factors, which creates the effect of reducing the model development cycle and minimizing errors, which is important, since it is important to integrate and enrich analytical models with industry information as a means of facilitating data analysis and improving the quality of management decisions.

Within the production cycle, modelling can be effectively used both at the stage of justification and innovative implementation, as well as during the implementation of production technologies (O'Kane *et al.*, 2000; Mealy & Teytelboym, 2022). However, it is at the operational stage that decision-making modelling can potentially be most useful, as it results in optimizing the use of resources, taking preventive measures against possible risks, and achieving the set goals in a timely manner. Thus, the advantages of using modelling as a decision-making tool in the field of green production in a post-industrial society include the following:

- modelling allows highlighting the most important and influential elements of decision-making;
- this way of decision-making eliminates gaps in the system and helps to identify new problems and obstacles that could not be foreseen in advance;
- this method facilitates adequate work with the problem, allows developing alternative options and ways;
- effective and timely modelling helps to optimize and improve existing models, introduce novelty and innovation into the existing system.

The disadvantages of using modelling in decision-making include the following

- difficulty in determining the parameters of influence;
- limited reflection of the actual functioning of production processes;
- imperfection of the assessment methodology as the basis for model design.

Despite several difficulties that inevitably arise in the process of decision-making modelling, this method requires due attention and occupies a prominent place in the decision-making process (Fourquet, 2019).

Based on the above, it can be established that various researchers believe that post-industrial society is characterized by critical thinking, flexibility, and creativity in approaching problem situations. Thus, this indicates the possibility of rapid adaptation of its subjects, as well as the widespread use of emotional intelligence. It is these qualities that can be effectively implemented in a decision-making modelling system, bringing the effect of innovative rethinking of old model variants, adding dynamism and efficiency to them.

Conclusions

Based on the goal set in this study, it is worth noting that it is necessary to predict the effectiveness of using modelling for decision-making in the field of green production in a post-industrial society synergistically with the basic principles of the circular economy and taking into account the specifics of individual production areas, the priority factor and time constraints, considering the available resource and the possibility of accumulating and integrating information data as a starting point. Only a comprehensive multifactorial approach makes it possible to determine strategic priorities for the use of a particular decision-making model in harmony with the unchanging principles of sustainable development and the innovation and information orientation of the development of post-industrial society. Modelling decision-making in the production sphere of a modern post-industrial society makes it possible to solve several problematic aspects of the production process management system: risk management, effective combination of rational and intuitive, involvement of creativity and critical thinking in the decision-making process, active implementation of innovative approaches, development of effective alternatives and realistic forecasting of the consequences of decision-making.

The study has succeeded in substantiating the feasibility of using different approaches to modelling (rational, intuitive, creative, etc.) under the existing production conditions and decision-limiting factors. It is proved that the models should be characterized by clear structuredness, regulation, reliability of the initial information, and consider such factors as relevance, priority, and novelty of the problem and urgency of its solution. Adaptation of decision-making models relevant to the production

processes of a post-industrial society to the specific requirements of a green economy and the principles of sustainable development are relevant vectors for further research, since the value and significance of modelling lies in its practical application. In addition, based on the results obtained, the study developed a model for optimizing green production. It is established that it is an important tool for achieving sustainable development goals, as it allows enterprises to increase production efficiency, reduce environmental impact and increase competitiveness. Given this, the study reveals its structure, establishes a number of fundamental principles, and compares its advantages and disadvantages. It should be noted that the proposed model is promising, as enterprises engaged in green production can implement a monitoring and management system that will collect data on the technological process, product characteristics and emissions, and use it to train the optimization model.

Among the prospects for further research is the practical implementation of modelling as a common tool for decision-making in production processes, studying the level of its successful performance and significance. It is also promising to study the possibilities of replacing the method of experiment with modelling to reduce resource costs and with the use of modern innovative technologies. A separate vector for further research is the active use of computer modelling methods.

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Conflict of Interest

None.

References

- [1] Aliyev, T., & Aliyeva, Sh. (2022). Economic forecast of further development for oil suppliers to world markets against the background of the development of renewable energy sources. *Scientific Horizons*, 25(7), 123-132. doi: 10.48077/scihor.25(7).2022.123-132.
- [2] Ding, R.X., Palomares, I., Wang, X., Yang, G.R., Liu, B., Dong, Y., Herrera-Viedma, E., & Herrera, F. (2020). Large-Scale decision-making: Characterization, taxonomy, challenges and future directions from an Artificial Intelligence and applications perspective. *Information Fusion*, 59, 84-102. doi: 10.1016/j.inffus.2020.01.006.
- [3] Durbach, I.N., & Montibeller, G. (2019). Behavioural analytics: Exploring judgments and choices in large data sets. *Journal of the Operational Research Society*, 70(2), 255-268. doi: 10.1080/01605682.2018.1434400.
- [4] Flores-Garcia, E., Bruch, J., Wiktorsson, M., & Jackson, M. (2021). Decision-making approaches in process innovations: An explorative case study. *Journal of Manufacturing Technology Management*, 32(9), 1-25. doi: 10.1108/JMTM-03-2019-0087.
- [5] Fourquet, R. (Ed.). (2019). *Handbook on green growth*. Northampton: Edward Elgar Publishing.
- [6] Gershwin, S.B. (2018). The future of manufacturing systems engineering. *International Journal of Production Research*, 56(1-2), 224-237. doi: 10.1080/00207543.2017.1395491.
- [7] Gigerenzer, G., & Gaissmaier, W. (2011). Heuristic decision making. *Annual Review of Psychology*, 62, 451-482. doi: 10.1146/annurev-psych-120709-145346.
- [8] Goncharenko, M., Parkhomenko, N., & Luchyn, O. (2020). "Green" economy as a direction to achieve sustainable ecological and economic development of the region. *Actual Problems of the Economy*, 6(228), 6-15. doi: 10.32752/1993-6788-2020-1-228-6-15.
- [9] González-Prida, V., & Carnero, M. (2021). *Advanced models and tools for effective decision making under uncertainty and risk contexts*. Hershey: Business Science Reference. doi: 10.4018/978-1-7998-3246-1.
- [10] Han, H., & Xia, S. (2021). An agro-based society after post-industrial society: From a perspective of economic growth paradigm. *Social Sciences*, 10(12), article number 455. doi: 10.3390/socsci10120455.

- [11] Hurzhyi, N., Kravchenko, A., Kulinich, T., Saienko, V., Chopko, N., & Skomorovskyi, A. (2022). Enterprise development strategies in a post-industrial society. *Postmodern Openings*, 13(1), 173-183. [doi: 10.18662/po/13.1Sup1/420](https://doi.org/10.18662/po/13.1Sup1/420).
- [12] Johansson, G., & Winroth, M. (2010). Introducing environmental concern in manufacturing strategies: Implications for the decision criteria. *Management Research Review*, 33(9), 877-899. [doi: 10.1108/01409171011070305](https://doi.org/10.1108/01409171011070305).
- [13] Julmi, C. (2019). When rational decision-making becomes irrational: A critical assessment and re-conceptualization of intuition effectiveness. *Business Research*, 12, 291-314. [doi: 10.1007/s40685-019-0096-4](https://doi.org/10.1007/s40685-019-0096-4).
- [14] Käki, A., Kemppainen, K., & Liesiö, J. (2019). What to do when decision-makers deviate from model recommendations? Empirical evidence from hydropower industry. *European Journal of Operational Research*, 278(3), 869-882. [doi: 10.1016/j.ejor.2019.04.021](https://doi.org/10.1016/j.ejor.2019.04.021).
- [15] Kushlyk-Dyvulska, O., & Kushlyk, B. (2014). *Fundamentals of decision-making theory*. Kyiv: National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute".
- [16] Kuzmin, O., Stanasiuk, N., & Berdnik, D. (2021). Forecasting economic result of manipulation using game theory modeling. *Economics, Entrepreneurship, Management*, 8(1), 1-13. [doi: 10.23939/eem2021.01.001](https://doi.org/10.23939/eem2021.01.001).
- [17] López Bello, C.A., Medina García, V.H., & Udden, L. (2014). Decision-making model for the development of productive capacity as a component of a knowledge management system. *Tecnura*, 18(2), 16-29. [doi: 10.14483/udistrital.jour.tecnura.2014.DSE1.a01](https://doi.org/10.14483/udistrital.jour.tecnura.2014.DSE1.a01).
- [18] Mahrinasari, M., Hussain, S., Yapanto, L.M., Esquivel-Infantes, S.M., Untari, D.T., Yusriadi, Y., & Diah, A. (2021). [The impact of decision-making models and knowledge management practices on performance](https://doi.org/10.1016/j.asj.2021.01.001). *Academy of Strategic Management Journal*, 20(2).
- [19] Mealy, P., & Teytelboym, A. (2022). Economic complexity and the green economy. *Research Policy*, 51(8), article number 103948. [doi: 10.1016/j.respol.2020.103948](https://doi.org/10.1016/j.respol.2020.103948).
- [20] Norouzi, N. (2021). Green economy: A necessary decision to be taken. *Universal Journal of Finance and Economics*, 1(1), 3-12. [doi: 10.31586/ujfe.2021.108](https://doi.org/10.31586/ujfe.2021.108).
- [21] O'Kane, J., Spenceley, J.R., & Taylor, R. (2000). Simulation as an essential tool for advanced manufacturing technology problems. *Journal of Materials Processing Technology*, 107(1-3), 412-424. [doi: 10.1016/S0924-0136\(00\)00689-0](https://doi.org/10.1016/S0924-0136(00)00689-0).
- [22] Radziszewska-Zielina, E., Adamkiewicz, D., Szewczyk, B., & Kania, O. (2022). Decision-making support for housing projects in post-industrial areas. *Sustainability*, 14(6), article number 3573. [doi: 10.3390/su14063573](https://doi.org/10.3390/su14063573).
- [23] van der Zee, D.J. (2006). Modeling decision making and control in manufacturing simulation. *International Journal of Production Economics*, 100(1), 155-167. [doi: 10.1016/j.ijpe.2004.11.001](https://doi.org/10.1016/j.ijpe.2004.11.001).
- [24] Zhang, H., Roy, U., & Tina Lee, Y.T. (2020). Enriching analytics models with domain knowledge for smart manufacturing data analysis. *International Journal of Production Research*, 58(20), 6399-6415. [doi: 10.1080/00207543.2019.1680895](https://doi.org/10.1080/00207543.2019.1680895).

Моделювання прийняття рішень в області зеленого виробництва в постіндустріальному суспільстві

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Анотація. Сучасні управлінські процеси мають вирішити комплексне завдання оптимального прийняття рішень та своєчасного ефективного прогнозування їх результатів, для вибору вдалих комбінацій рішень у тій чи іншій виробничій сфері нового інформаційно-інноваційного суспільства, що прийшло на зміну індустріальній епосі. У світлі окресленої проблематики особливої уваги заслуговує процес моделювання як ефективний механізм прийняття рішень та регулювання ризиків. Метою дослідження було висвітлення моделювання як ефективного методу прийняття рішень в умовах зеленого виробництва в постіндустріальному суспільстві, обґрунтування доцільності його використання на різних рівнях виробничого процесу. У ході дослідження застосовано зокрема теоретичні методи – вивчення наукових матеріалів та результатів досліджень, опис та порівняння. А також проведено узагальнення та аналіз результатів. У статті розглянуто основні підходи до стратегії впровадження моделювання прийняття рішень в області зеленого виробництва в постіндустріальному суспільстві, надано розгорнуте визначення його структурних елементів та пріоритетних принципів. З'ясовано, що моделювання як інструмент управління застосовується при розробці досить складних виробничо-управлінських рішень і являє собою побудову моделі чи системи моделей досліджуваного процесу чи явища для його вивчення, аналітики та формування відповідного віяла альтернатив результату. Проаналізовано основні види моделювання за різними класифікаціями, досліджено можливості застосування окремих із них у системі прийняття рішень у виробничій площині. Надано висновки щодо ефективності та результативності застосування у виробничих процесах сучасного інноваційно-інформаційного економічного простору. Обґрунтовано доцільність використання різних підходів до моделювання прийняття рішень в залежності від ряду впливових чинників. Доведено можливість вирішення виробничої багатозадачності прийняття рішень за допомогою створення моделей. Вказані результати дослідження мають практичну значимість для удосконалення управлінських процесів в області зеленого виробництва в постіндустріальному суспільстві, незалежно від форм власності, об'ємів виробництва та сфери діяльності

Ключові слова: інновації; модель системи; зелена економіка; альтернативні варіанти рішень; виробничий процес

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A system for managing the local economic development of communities

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Abstract. In today's environment, it has become an important task to support and stimulate local economic development of communities to improve the living standards of the population and create sustainable and competitive community structures. The purpose of this study is to examine the system of management of local economic development of communities, which is becoming an increasingly important task in the context of social, economic, and political development of modern societies. The research has yielded the following results: using high-quality data from the publication *Local economic development: Models, resources and financing tools*, various models and approaches to managing local economic development of communities, including centralized and decentralized systems, as well as options for involving citizens in decision-making, were considered; using statistical sources of the Information and Analytical System for Monitoring Statistical and Administrative Indicators of Territorial Communities, Statistics Portal of Lithuania, Statistics Poland, a comparative analysis of local community development management systems in Ukraine, Poland, and Lithuania was carried out; the level of participation of citizens and stakeholders in decision-making processes and the development of local economic development strategies were analysed; the use of technology was assessed to improve the productivity of local economic development through ground research from the Centre for Innovation Development; the mechanisms of cooperation and coordination between different levels of government with the influence of factors were investigated and compared; territorial communities were analysed by region with regard to citizens' appeals on the activities of local self-government bodies using statistical data from the website of the Government Contact Centre; recommendations and strategies for improving the system of local economic development management were developed. The study of the system of management of local economic development of communities is of great practical importance in modern conditions, where a favourable economic environment at the level of local communities is an important factor for improving the living standards of the population and creating sustainable and competitive community structures

Keywords: infrastructure and investments; partnership between sectors; resource efficiency; increasing competitiveness

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Introduction

Implementing an effective system of local economic development management is a key task in the modern world. Communities are fundamental components of social and economic life, and their success in development affects the overall level of well-being and sustainability of the socio-cultural environment. Local economic development is a strategically important task for ensuring sustainable growth, meeting the vital needs of the population, and preserving natural resources.

The modern world is facing numerous challenges, such as globalization, climate change, demographic changes, and technological progress. These challenges require new approaches to managing economic development at the local level. An effective system of local economic development management requires innovative strategies, a wide range of tools and the active participation of citizens. Therefore, studying the system of local economic development management is of strategic importance. The significance of this topic lies in the fact that proper management of local development allows achieving greater sustainability, realizing the potential of local resources, and contributing to the competitiveness of communities. The research on this topic includes consideration of numerous aspects, such as the effectiveness of management tools, involvement of citizens in decision-making, consideration of regional specifics, and the problems of implementing innovative approaches to local economic development, developing strategies and programmes, and coordinating efforts between different levels of government and NGOs.

Currently, there is a significant amount of research that focuses on the management of local economic development of communities. Scientists and experts from different countries have already studied this topic, analysing its various aspects and the experience of developed countries in its development. In her work, Ukrainian scientist T. Fedorenko (2023) analysed approaches related to management and functionality that relate directly to the local economic development of communities in such countries as: Germany, the USA, Poland, China, and Ukraine. Based on this extensive analysis, she developed recommendations that will primarily contribute to a significant improvement of the local economy in Ukraine. I. Storonyanska *et al.* (2021) were able to analyse the financial support for tourism development by local governments in Ukraine based on information from official sources of local governments of Ukrainian territorial communities with tourism potential. The analysis revealed that only four of the five elements that make up the tourism infrastructure had an adequate level. The tourism industry faced a problem with one element due to the epidemic. Z. Siryk *et al.* (2021) assessed the results of the financial decentralization component and used this assessment to identify ways to improve the effectiveness of administrative and territorial reform in Ukraine.

The Ukrainian researchers T.V. Malyshevskiy & V.V. Stefinin (2021) examined the management of community economic development using the concept of local economic development. The authors also proposed a model

of a management system in communities based on the identification of instruments of influence to ensure rapid economic growth. O.Yu. Matveieva (2021) reviewed and studied the experience of Ukrainian communities in the context of the European paradigm of sustainable development. The author suggested the need for the transition of Ukraine's governance system from "economism" of social relations to "smart" governance that meets the requirements and needs of informed and considered decisions in the interaction of all components of sustainable development in a globalized society. N.I. Galunets (2023) analysed the peculiarities of local economic development and argued its importance for territorial communities in the period of post-war reconstruction of Ukraine.

The area covered by these studies does not take into account certain aspects: there is no specific attention to ways to stimulate the local economy in times of crisis, nor to the importance of using innovations and technologies to improve the efficiency of local economic development, nor does it consider the role of the public in the formation and implementation of local development strategies. The purpose of the study is to systematically analyse and develop specific recommendations and strategies for improving the system of local economic development management in communities. In studying the system of local economic development management, two main tasks can be identified that should be considered and addressed during the study. The first task is focused on comparing and analysing models of local economic development management. To accomplish it, the following steps should be taken: consider different models and approaches to local economic development management, including centralized and decentralized systems, as well as options for involving citizens in decision-making; conduct a comparative analysis of local economic development management systems in different countries or regions; analyse the level of participation of citizens and other stakeholders in decision-making processes.

The second task is aimed at assessing the use of technology to increase the productivity of local economic development. In order to successfully complete this task, the following actions should be taken: assess the use of technology to increase the productivity of local economic development; explore mechanisms of cooperation and coordination between different levels of government (local, regional, national) to ensure effective local development management and consider the impact of various factors, such as globalization, climate change, demographic changes, technological progress, on them; analyse territorial communities by region in terms of their citizens' appeals on the activities of local self-government bodies.

Materials and Methods

The materials used for this study are important sources of information that allowed considering different models and approaches to managing local economic development of communities, as well as to conduct a comparative analysis of these systems. First, the study is based on the source

Local economic development: Models, resources and financing tools (2020), and then for the statistical study, data from the Information and analytical system for monitoring statistical and administrative indicators of territorial communities (2023), Statistics portal of Lithuania (2023), Statistics Poland (2023), research from the Centre for Innovation Development and official data from the website of the Government Contact Centre were used. Thus, using the sources, the study identified key trends and principles that can serve as a basis for further strategies and recommendations in the field of local economic development of communities.

The method of analysis was used to study territorial communities by region, where citizens were most active in addressing issues related to the activities of local governments. It also allowed examining the level of participation of citizens and other stakeholders in decision-making processes and the development of local economic development strategies, thereby creating a basis for further understanding of the system's functioning. The statistical method was used to collect and process numerical data from territorial communities in different regions to determine how technology affects economic development at the local level. The processing of these data allowed identifying the specifics of technology use in different regions, which helped to understand different approaches and strategies in the development of local economies. In addition, the statistical method allowed determining the key factors that influence the effectiveness of local economic development, in particular, in the context of technology use.

Another method used in this study is comparison. This method has been used to identify differences in the systems of local community development management in different countries. The choice of countries for the analysis, such as Ukraine, Lithuania, and Poland, has several justified reasons. These countries are located in geographically close regions of Central and Eastern Europe, which makes it possible to compare similar socio-cultural and economic contexts. In addition, the choice of these countries is based on their interest in international comparison and exchange of best practices in local development. The theoretical basis of this analysis is based on the concepts of local development, decentralization, and administrative efficiency. Local development is seen as a key element of sustainable social and economic progress, and its effective management is becoming a crucial factor in achieving this goal. Decentralization, in turn, implies the transfer of power and responsibility to the local level, promoting greater citizen participation in decision-making. In addition, the use of this method allowed for a structured and reasonable study of the effectiveness and features of different systems of local economic development management.

The next method was synthesis. It was used to combine different types of information, concepts, and approaches to create a new, integrated view of the management system. In particular, it was needed to consider different models and approaches to managing local economic development, including centralized and decentralized systems, as well

as options for involving citizens in decision-making. This method allowed for a deeper understanding and integration of different aspects of the local economic development governance system, creating new insights and approaches for further research and practical application. It also helped to explore the mechanisms of cooperation and coordination between different levels of government to ensure effective local development management. The abstraction method was also used in the course of the research. It allowed highlighting key aspects and general principles of the system, ignoring details and specific contexts. In addition, it helped to generalize the data obtained and identify universal principles applied in different local communities to improve the efficiency of local economic development management.

Other methods used in the study were generalization and specification. The first of these methods was used to summarize the key findings and main aspects of the study. In particular, this method allowed focusing on the most important ideas and results of the study. It also helped to develop specific recommendations and strategies for improving the system of local economic development management. Specificity was used to identify the impact of various factors, such as globalization, climate change, demographic change, and technological progress, on local economic development.

Results

Comparison and analysis of management models of local economic development of communities

Comparing and analysing models of local economic development management is an important tool for understanding the effectiveness of different approaches and identifying optimal strategies. In addition, this study will help to deepen the understanding of the local economic development management system.

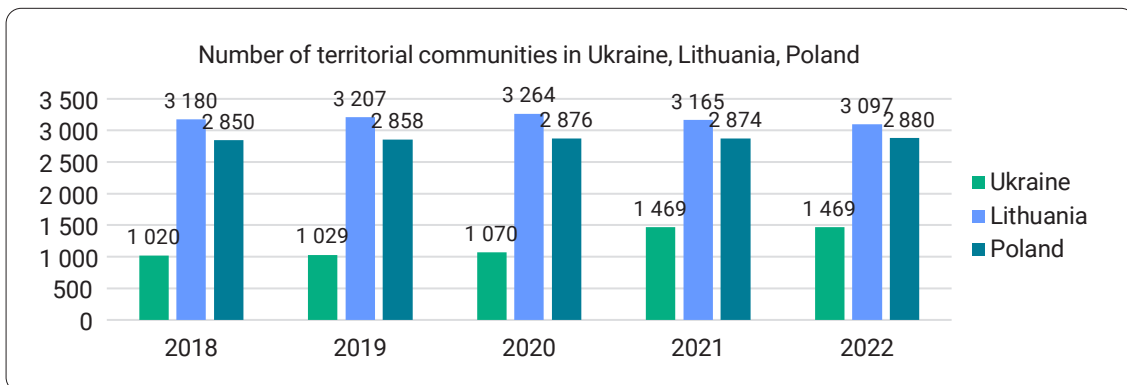
To begin with, different models and approaches to local economic development management, including centralized and decentralized systems, as well as options for involving citizens in decision-making, were considered. There are several different models and approaches to managing local economic development in communities. Table 1 summarizes some main models, including centralized and decentralized systems, as well as approaches to engaging citizens in decision-making.

Each of these models can be effective, depending on the specific conditions and objectives of the community. Usually, a combination of different models can be optimal for achieving successful local economic development. Further, based on data from statistical sources of the Information and analytical system for monitoring statistical and administrative indicators of territorial communities (Information and analytical..., 2023), Statistics portal of Lithuania (2023), Statistics Poland (2023), Figure 1 was developed, which shows the number of territorial communities for the years 2018 – second half of 2022 in Ukraine, Lithuania, and Poland.

Table 1. Basic models and approaches to involve citizens in decision-making

Name of the model/approach	Characteristic	Advantages	Disadvantages
Centralized	In a centralized management system, decisions and strategies are formed and adopted at the central level of government (state or regional).	Efficiency in solving national or regional problems, standardization of regulations.	Lack of consideration of local characteristics, less incentive for local entrepreneurship, limited access of citizens to power.
Decentralized	In a decentralized system, power and responsibility are transferred to a local level of government, such as local authorities or local governments.	Greater flexibility, consideration of local needs, support of local entrepreneurship, greater access of citizens to power.	Risk of heterogeneity of strategies, less coordination in solving national problems.
Partnership	In this approach, partnerships are formed between various stakeholders such as government, business, the non-profit sector and citizens.	Involvement of various resources and knowledge, more effective solution of complex problems.	Requires a large amount of coordination and agreement between all participants.
Model of citizen participation	In this model, the emphasis is on the active participation of citizens in decision-making and influence on the economic development of their communities.	Increasing the legitimacy of decisions, taking into account the real needs of citizens.	May lead to difficulties in reaching consensus, requires time and resources to engage citizens.

Source: developed by the author using the resource Local economic development: Models, resources and financing tools (2020)

**Figure 1.** The number of territorial communities

for the years 2018-the second half of 2022 in Ukraine, Lithuania, and Poland

Source: developed by the author based on the resources Information and analytical system for monitoring statistical and administrative indicators of territorial communities (2023), Statistics portal of Lithuania (2023), Statistics Poland (2023)

Based on the statistical information provided on the number of territorial communities in Ukraine, Lithuania, and Poland for the years 2018-2022, the following conclusions were made. The number of territorial communities in Ukraine has been growing since 2018 by 449 communities in 2021-2022. This indicates the implementation of the territorial structure reform and the amalgamation of communities for more efficient resource management and development of territories. The number of territorial communities in Lithuania has shown less fluctuation over the period and remains in the range of 3180-3264. This may indicate the stability of the territorial structure and the absence of significant changes in the number of communities. The number of territorial communities in

Poland also shows a slight increase from 2018 by 30 communities in 2022. This indicates a certain development of the country's territorial structure, although the pace of change is moderate.

Thus, the general trend in the number of territorial communities in the countries under consideration indicates a certain movement towards improving the territorial structure and finding optimal forms of governance at the local community level. In the context of the economic comparative analysis of regional development, Figure 2 shows the dynamics of territorial community revenues in the period from 2020 to 2022 in euros. The study covers not only Ukraine, but also two Central European countries – Lithuania and Poland.

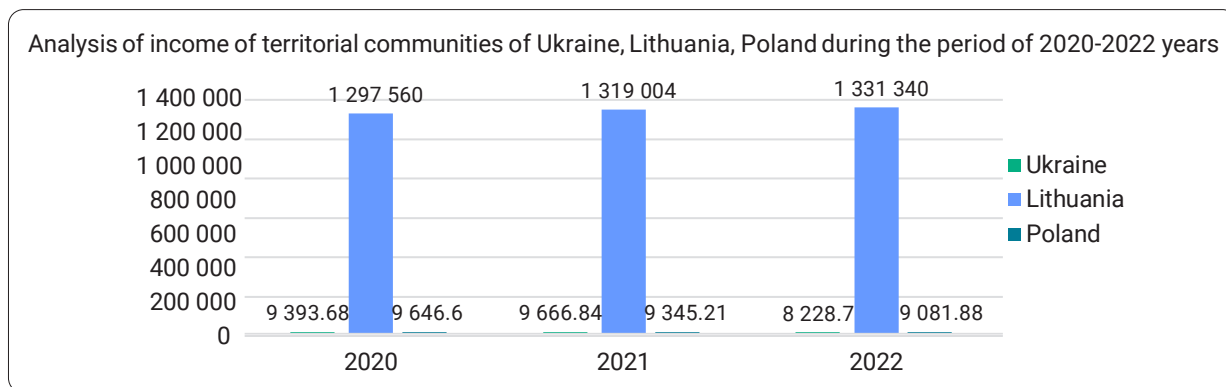


Figure 2. The dynamic of income of territorial communities of Ukraine, Lithuania, Poland in the period from 2020 to 2022 in euros

Source: developed by the author based on resources Information and analytical system for monitoring statistical and administrative indicators of territorial communities (2023), Statistics portal of Lithuania (2023), Statistics Poland (2023)

Thus, the comparative analysis shows similar trends in the development of local systems, but there is still a variety of strategies and approaches, which is determined by the cultural, historical, and economic characteristics of each country. Based on the data on local community revenues for 2020-2022 in Ukraine, Lithuania, and Poland, several conclusions can be drawn. Ukraine has a certain decrease in the revenues of territorial communities from 2020 to 2022 by 13%, primarily due to the appreciation of the euro against the hryvnia and the introduction of martial law in the country. Lithuania is expected to see a slight increase of 2% between 2020 and 2022. Poland is marked by significant fluctuations, but also shows a slight decrease in revenues from 2020 to 2022 by 6%. The overall level of territorial community revenues in Lithuania is significantly higher than in Ukraine and Poland. Lithuania has relatively stable growth over this period because it has the euro currency.

Lithuania has higher total revenues of territorial communities compared to Ukraine and Poland. In turn, Ukraine shows some economic growth, but its level of revenues in 2022 remained lower than in Lithuania and Poland due to the war. This data can serve as a basis for further

economic analyses and the development of strategies for managing territorial development in different countries. The analysis of the level of participation of citizens and other stakeholders in decision-making processes and the development of local economic development strategies is of great importance, as it reflects the activity of citizens in the formation and implementation of initiatives that will contribute to development. The ability of citizens to participate in decision-making contributes to the consideration of diverse needs and views in the development of strategies, which contributes to the wider implementation of solutions and ensures their suitability for specific community conditions. Citizen participation in local initiatives also increases the level of legitimacy and trust in the decisions made. Therefore, analysing the level of participation of citizens and other stakeholders in decision-making processes and the development of local economic development strategies plays a key role in ensuring sustainability and addressing the diverse needs of communities. Figure 3 illustrates the participation of citizens and other stakeholders as a fundamental element of democratic and effective governance aimed at achieving economic development.

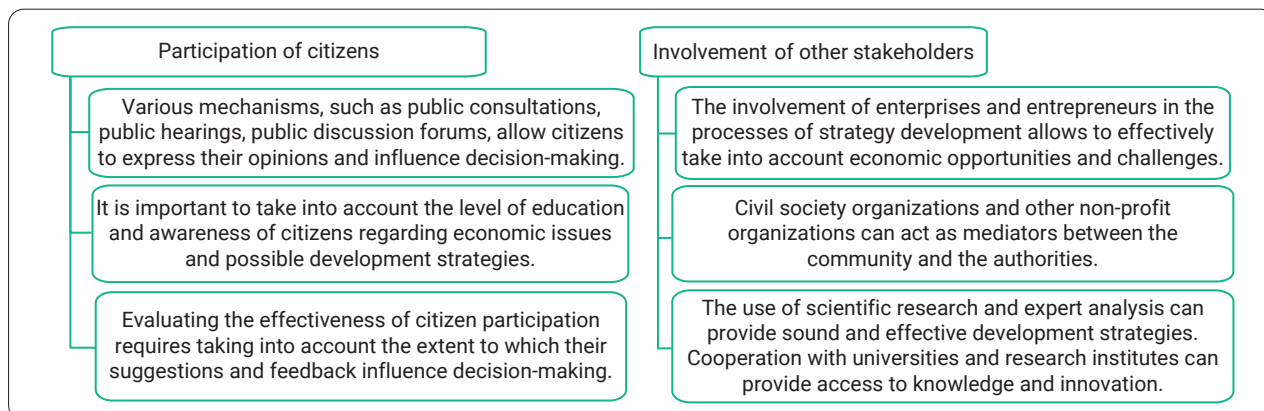


Figure 3. The participation of citizens and other stakeholders in decision-making processes and development of local economic development strategies

Source: developed by the author

The overall conclusion is that maximizing the participation of citizens and various stakeholders in the governance and strategic development of local economies is an important prerequisite for sustainable and inclusive economic growth. Ensuring transparency, equity, and access to information can contribute to the development of effective and acceptable strategies for all stakeholders.

Evaluation of the use of technologies to increase the productivity of local economic development

The use of technology to increase the productivity of local economic development plays a critical role in shaping a sustainable and competitive socio-economic environment. Based on data from sources taken from the official website of the Centre for Innovation Development, Figure 4 shows the index of local e-democracy in Ukraine for 2018-2020.

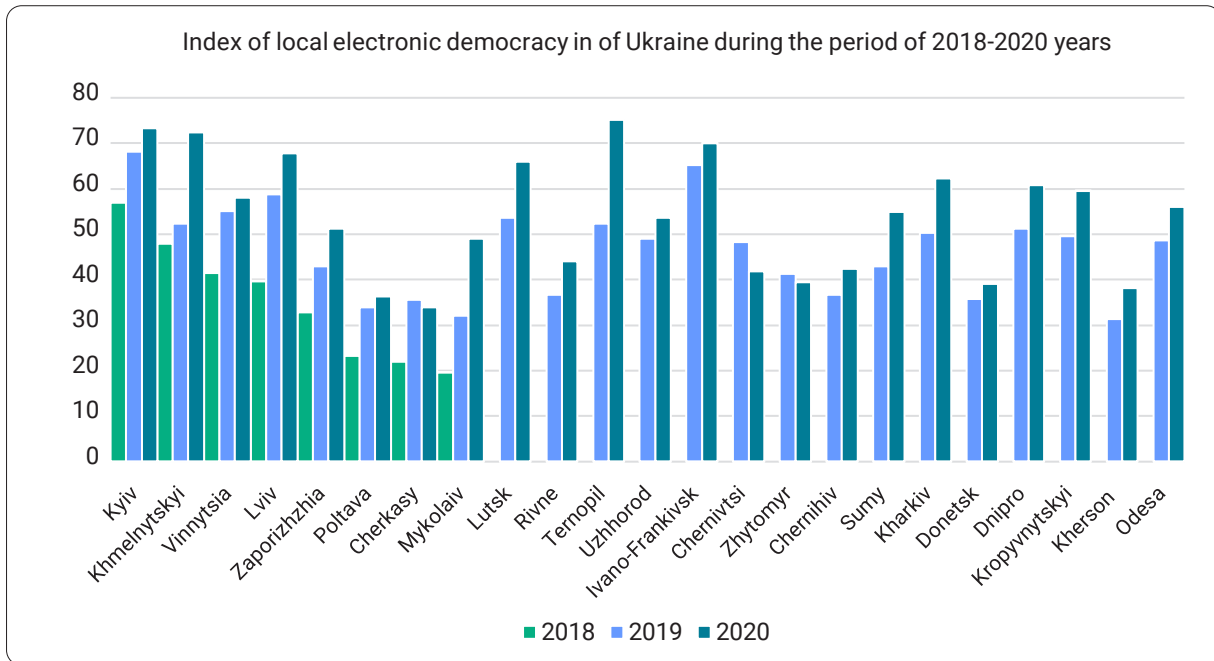


Figure 4. Index of local e-democracy in Ukraine for 2018-2020

Source: developed by the author based on the resource by H. Prykhodko *et al.* (2018), A. Yemelyanova *et al.* (2019), A. Yemelyanova & S. Loboyko (2020)

This chart shows that most cities have experienced some positive growth in the indicator over the past three years. The highest growth rates are observed, in particular, in Ivano-Frankivsk, Ternopil and Kyiv. Also, as expected, the capital Kyiv has the highest average score, indicating greater opportunities for high earnings. However, other cities, such as Lviv, Odesa, and Kharkiv, also have fairly high averages. Some cities are experiencing growth, while others may be experiencing a relative decline, such as Kherson. The difference between the maximum and minimum values is large, indicating economic inequality between different regions. This data can serve as a basis for a deeper analysis of the regional economic situation, earnings dynamics, and opportunities for improving economic development in individual cities. The absence of data for 2018 is explained by the fact that although a request was sent to the cities during the study, not all of them provided the relevant data. The relevance of the data for 2021-2022 is currently problematic, primarily due to some important events that have shaped the socio-economic landscape. First, the global COVID-19 pandemic has significantly complicated the collection and analysis of economic data due to the suspension of certain activities and restrictions on the work of statistics

collection agencies. Secondly, the outbreak of Russia's full-scale invasion of Ukraine has caused additional difficulties in keeping records and analysing economic indicators. Urgent measures to ensure the security and defence of the country required the suspension of some economic operations and led to delays in the work of government agencies and organizations, including the collection, processing, and publication of economic data. These circumstances resulted in a temporary lack of up-to-date data for the period.

In addition, it is important to consider the impact of various factors on local economic development. Therefore, Table 2 compares the mechanisms of cooperation and coordination between different levels of government (local, regional, national) with the impact of factors such as globalization, climate change, demographic changes, and technological progress on local economic development.

This table provides a summary of how different levels of government can cooperate and coordinate to ensure effective local economic development, considering the impact of global factors. Using data from the Government Contact Centre website, the most active territorial communities were analysed by region in 2022 in terms of citizens' appeals on local government activities (Fig. 5).

Table 2. Comparison of mechanisms of cooperation and coordination between different levels of government with the influence of factors

Factors	Levels of Government		
	Local level	Regional level	National level
Globalization	Development of local enterprises that can compete in the global market. Conclusion of international partnerships and trade agreements.	Participation in regional business associations and other international organizations. Joint solution to global problems, such as environmental issues.	Development of national export strategies, participation in international economic forums.
Climate change	Implementation of local initiatives to reduce emissions and adapt to climate change.	Joint projects at the regional level to join forces in the fight against climate change.	Development of national strategies for reducing the impact on climate change and participation in international environmental agreements.
Demographic changes	Development of local programs to solve problems related to changes in the population structure.	Participation in regional initiatives on migration and the labour market.	Determination of national policies regarding demographic changes and social programs.
Technological progress	Introduction of new technologies in the local economy and educational programs.	Joint initiatives with regional companies for the development of new technologies.	Development of national strategies for digital transformation and innovation.

Source: developed by the author

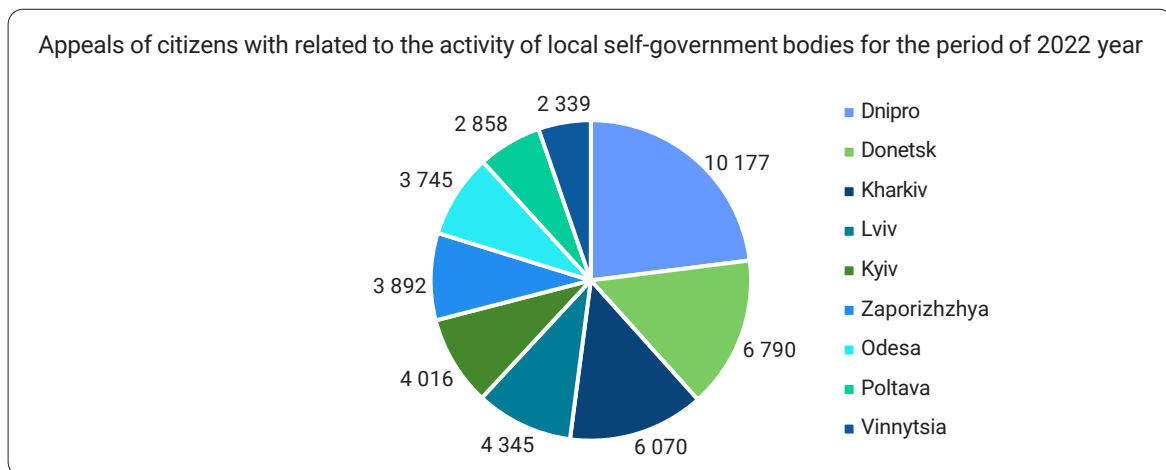


Figure 4. The most active territorial communities in oblasts by region for 2022 regarding citizens' appeals regarding the activities of local self-government bodies

Source: developed by the author

The largest number of appeals was received from the Dnipro territorial community, which indicates the activity and involvement of the local population. Even in the face of certain difficulties due to the conflict situation, citizens of Donetsk territorial communities express their questions and needs. In turn, Odesa and Zaporizhzhia territorial communities are marked by an average number of appeals, which may indicate stability, even development and a balance between the needs of citizens and the effectiveness of local self-government. Poltava and Vinnytsia territorial communities are less active in responding to citizens' appeals compared to other regions. In general, in each region, requests from local communities are more related to compensation for damages to victims, provision of housing and

humanitarian aid to internally displaced persons. This data can be used to further study the problems and needs of communities in individual communities and to develop effective strategies for local governments to respond to them.

To improve the system of local economic development management, it is recommended to implement specific strategies and measures, such as creating an interaction platform, introducing a digital monitoring platform, ensuring public participation in decision-making processes, creating an innovation fund, and integrating education and training programmes. The creation of a centralized platform for interaction serves to exchange information and cooperation between government, business, and civil society. To implement this recommendation, a web portal

should be developed where stakeholders can share initiatives, project information and feedback.

The next recommendation relates primarily to the introduction of a digital monitoring platform, which is used to track development indicators and the use of resources. To implement this monitoring, it is necessary to use a geodata and analytics system for real-time reporting and analysis. In turn, to ensure public participation in decision-making processes, regular meetings and initiatives should be organized to help take citizens' opinions into account. Create a fund to finance innovative projects and enterprises. This fund can be created by developing competitive programmes for investors and defining selection criteria for financial support. To integrate education and training programmes to educate the local population, partnerships should be established with educational institutions and businesses to help create special programmes tailored to the needs of the community. These recommendations constitute a comprehensive approach to improving the local economic development management system in communities and will contribute to the creation of a sustainable and effective environment for development.

However, there are also problems that may arise during the implementation of these recommendations. One of these challenges may be the financial constraints associated with insufficient funding for development initiatives. To address this issue, it is important to consider additional funding opportunities, such as partnerships with businesses, grants, and investments. Another problem is related to the diversity of cultures and opinions of citizens, which can affect the formation of a single strategic direction for community development. To overcome this challenge, it is important to organize training and campaigns on intercultural understanding to support inclusiveness and joint development. Also, when creating a web portal or special programmes to educate the local population, there may be a problem related to technical difficulties, such as low technical literacy in the community. To address this, citizens should be provided with access to training resources and technical support to facilitate their participation in the digital environment. In the realm of political complexities related to changes in government and priorities, it can be difficult to ensure the sustainability of strategies. It is then necessary to consider the sustainability and continuity of strategies regardless of political changes, so as not to disrupt development processes.

Understanding these issues and implementing specific measures will help to create a stable and effective system of local economic development management for communities that meets the unique needs and conditions of each region. Considering all aspects of the study, the recommendations provided and the problems that may arise during implementation can serve as a strategic guide to improve the economic activity and social prosperity of communities. Proposals for expanding the use of innovative technologies, increasing the level of citizen participation, and optimizing the mechanisms of cooperation between

different levels of government form a practical basis for positive changes in the local economic development system.

Discussion

At the current stage of Ukraine's development, the economic condition of communities is determined by a complex of factors. Despite some progress in several regions, there are challenges that require attention and systemic solutions. Important areas for further development include supporting entrepreneurship and creating a favourable business climate, improving infrastructure to stimulate economic activity, developing educational and research initiatives to ensure a skilled workforce, and promoting innovative technologies. Social development and ensuring access to quality health and social services also remain key aspects. Ensuring coordination and cooperation between government agencies, the business community and communities is therefore essential to effectively address these challenges.

The topic of local economic development has also been studied by researchers E. Malizia *et al.* (2020). In their book, they highlighted the relevance of the theory to provide information support for local strategic planning in the context of significant differences in regional economic indicators. It is worth agreeing with the authors' opinion, as this study allows understanding the basic concepts and principles that determine local economic development and taking them into account when formulating strategies and plans at the local level. The analysis of differences in regional economic indicators, noted by the authors, indicates a different approach to planning and the use of theoretical foundations to ensure effective development management in different territories. R.D. Lamie & S.C. Deller (2020) investigated and critically analysed local and regional food networks. Thus, their results show that most studies currently lack a theoretical basis. It is worth agreeing with the authors' opinion, as the lack of theoretical underpinning indicates the need to develop or apply an appropriate theory to better understand and explain phenomena in food networks.

Other researchers who have examined the potential utilization and impact of human and natural resources in the Bulukumba region are H. Saleh *et al.* (2020). They found that the combined impact of natural and human resources affects the economic development of the region, but it is necessary to optimize and strengthen the potential of resources using modern technologies and changes in community culture, which will contribute to economic growth. It is appropriate to agree with the authors' opinion, since the determination of the joint impact of natural and human resources on the economic development of a region indicates their interaction and interdependence. The interest in optimizing and strengthening the potential of resources using modern technologies and changes in community culture indicates the need to adapt to change to promote economic growth.

Interested in studying the impact of community-based cash-for-work programmes in Jordan, M. Loewe *et al.* (2020) first examined in detail and then argued that such

programmes, if designed seriously and more broadly, can have significant benefits not only for their direct participants, even if - under the current structure - after payment for work, the impact on employment and investment remains limited, and the changed gender roles may be unsustainable. It is worth agreeing with the authors' view that cash-for-work programmes can serve as an effective tool to alleviate pressure on refugee host communities. These programmes not only promote employment and skills development, but can also have a positive impact on local infrastructure and social fabric. Haudi *et al.* (2020a) examined the socio-economic needs and challenges of local communities in Raub, Malaysia, and conducted a township survey of 300 respondents to develop recommendations and interventions. The authors' opinion is ambiguous. On the one hand, it is true that the socio-economic growth of rural areas is not limited to the problem of poverty alone. Other physical and psychosocial aspects can influence community development, and their consideration is important for formulating effective strategies. In addition, private-public partnerships in Malaysia have been shown to be empirically successful. Such partnerships can create additional opportunities for community development by providing support and resources. On the other hand, the study notes that there are many rural areas that have not been fully explored and developed. This can make it difficult to understand their potential and challenges, thus making it difficult to formulate effective strategies.

Other researchers who have studied the mobilization of communities of practice for local community development are E. Annan-Aggrey *et al.* (2022). They examined how this issue can accelerate Canada's Sustainable Development Goals (SDGs), and they also found out what benchmarks are needed for successful practices in community management. It is worth disagreeing with the authors' opinion, as the phrase used in the study, "progress has been made in some places" leaves room for ambiguity about specific achievements. This can lead to a sense of uncertainty about how well the SDGs have been implemented. The study also states too broadly that the local government level is recognized as a key place to develop efforts, especially as the SDGs are relevant to local community development. A. Catalinac *et al.* (2020) examined and analysed waste management strategies, networks, and economic progress at the local development level in contemporary Japan. In their conclusions, they confirm the theory and explain other aspects of Japanese policy, in particular, why there is a tendency to distribute pork to less profitable areas. It is worth agreeing with the authors' opinion, as the study is based on a theoretical concept that states that politicians motivate voters by organizing competitions between groups and distributing rewards depending on the level of support provided in elections. This approach makes logical sense, especially in the context of the political process.

Exploring the role of local communities in social media and protected area management separately, J. Pereira *et al.* (2022) conducted a social media study to examine how

local communities interact and are embedded in the structure and dynamics of communication between stakeholders, using Quirimbas National Park, Mozambique, as an example. Through the analysis, they were able to identify a network of limited cooperation that lacks bidirectional communication. It is worth agreeing with the authors' opinion, as the recommendation to improve communication and involve communities in decision-making processes is constructive. This emphasizes the importance of including communities in the development and implementation of conservation strategies. L. Haji *et al.* (2020) studied the role of local community participation in land and forest management. They explained the role of community participation in sustainable forest management, then introduced the barriers and drivers of local community participation, respectively, and highlighted some practical experiences of local community participation in forest management. The authors' opinion is ambiguous. The recognition that the conservation, protection, and sustainable use of forests has an important function in ensuring the environmental sustainability of the globe is constructive. Forests provide numerous ecosystem services, such as climate regulation, biodiversity conservation and soil fertility maintenance. But on the other hand, the introduction of social principles for agricultural systems and interventions requires specificity and detail to ensure their effectiveness.

The author of the book M. Patynska-Popeta & T. Zinchuk (2022) outlined how the community's view of rural economic development policy is evolving, as well as the factors that influence development prospects. The author's opinion is ambiguous. On the one hand, current economic trends suggest that the economic gap between rural and urban areas may be widening. Taking this difference into account is important for designing effective rural development policies. On the other hand, there is a need to consider a variety of development strategies, as there is no one-size-fits-all approach for all rural areas. Also, cooperation with community development professionals should be considered, which requires support and resources for their effective work. Haudi *et al.* (2020b) studied the socio-economic needs and gaps of local communities and then provided recommendations for offering the necessary assistance and interventions. They decided to develop a predictor of socio-economic success through a survey in Kuala Lipis District, Malaysia, with 300 respondents, plus a face-to-face interview. The authors' conclusion that the influence of the private and public sectors is explained by the socio-economic development of the country is noteworthy. This reflects the realization that cooperation between these sectors can be a key factor in ensuring sustainable community development. This is indicative of a practical approach to solving problems at the level of specific communities, particularly in the Kuala Lipis district in Malaysia.

In their study, H.B. Tantoh *et al.* (2021) provided practical evidence and lessons learned from good water management practices that focus on community economic development in northwest Cameroon. Through the analysis

of data collected through participatory research methods, the authors found that centralized control, prevalence of poverty, passive public participation, the private sector and low levels of local community participation continued to hinder the provision of water in these areas. It is appropriate to agree with the authors' view, as the study uses a literature review of sub-Saharan natural resource management initiatives that are successful and based on community participation. This is important to consider the context and learn from positive experiences. The study also recognizes power as a crucial determinant of access to resources. This contributes to an informed discussion of governance systems and their impact on resource allocation.

Researchers L. Guibrunet *et al.* (2021) analysed four Mexican forests and compared the results of the analysis with the literature on environmental justice and conservation. Through this detailed analysis, the authors concluded that achieving meaningful recognition of local communities' value systems requires: developing awareness of structural political and economic factors, and an epistemological transformation that permeates protected area management, where local value systems are considered as one of the various legitimate knowledge systems. It is worth agreeing with the authors' view that recognizing the three key factors that make it difficult to recognize local community value systems can be an important contribution to identifying and addressing problems in conservation management. However, it may be important to keep in mind that assessing value systems is a complex task, and that the diversity of perspectives and approaches in local communities should be considered. R. Huggins *et al.* (2021) investigated the impact of the Industrial Revolution on the influence of local communities in the UK. In conclusion, the authors identified one of the reasons for the limited impact of public policy on local and regional economic development. This reason is that historical industrialization has left a lasting imprint on contemporary culture in many regions, making it difficult to promote change. It is worth agreeing with the authors' view, as the use of historical data to assess the causal relationship between industrialization and cultural dimensions suggests that these factors interact. This can be useful for formulating regional development policies and strategies.

In their study, R. Rugeiyamu *et al.* (2021) examined and clarified the interaction of local governments to support economic development and service delivery to local communities in Tanzania. After analysing and researching documentary reports, it was concluded that local governments promote economic development by providing loans with favourable terms and improving business infrastructure. It is worth agreeing with the authors' opinion, as the study honestly and objectively identifies problems, such as difficulties with non-performing loans and failure to provide entrepreneurial skills. This is key to formulating strategies and policies to address these challenges.

In summary, the research study of the local economic development management system in Ukraine, Poland, and

Lithuania has identified key aspects and trends that determine the success of economic development at the local level. An analysis of different governance models, the level of citizen participation, the use of technology and coordination between different levels of government has identified important aspects and issues affecting community development. The study identified important recommendations for improving the effectiveness of governance systems, such as increasing the role of citizens in governance processes, using modern technologies, and strengthening cooperation at different levels of government. In addition, it was noted that many studies on the economic development of local communities are aimed at identifying optimal models of governance and resource allocation to achieve efficiency and equity at the local level. The results of certain studies help to identify factors that influence the development of local communities, as well as to develop strategies to ensure sustainability and consider the unique characteristics of each region. Such research is aimed at addressing the specific problems and needs of local communities, which is key to supporting the development of society as a whole.

Conclusions

As a result of the study of the local economic development management system, it is important to note that the analysis of different models and approaches to managing local economic development of communities revealed significant differences between centralized and decentralized systems, as well as different options for involving citizens in decision-making.

Using official statistical data, an analysis of the dynamics of territorial community revenues in the period from 2020 to 2022 for Ukraine, Lithuania, and Poland was conducted, which revealed certain similar trends in the development of local systems, but also highlighted the diversity of strategies and approaches in each country. According to the findings, the number of territorial communities in Ukraine has increased since 2018 by 449 communities in 2021-2022, which indicates the implementation of the territorial structure reform and amalgamation of communities for more efficient resource management and development of territories. Lithuania is marked by a stable number of 3180-3264 communities, while Poland also shows a moderate increase since 2018 by 30 communities in 2022. As for the revenues of territorial communities, Ukraine has a certain decrease by 13%, so it remains lower compared to Lithuania, which has a 2% increase in income, while Poland has a decrease in income by 6%, but still has more income from territorial communities compared to Ukraine. The general trend is towards economic growth and stabilization, but different countries are developing at different rates and approaches. The assessment of the level of citizen and stakeholder engagement revealed the importance of their role in shaping local economic development strategies.

The analysis of the use of technology to improve the productivity of local economic development allows identifying key aspects that affect the effectiveness of community

development. It was conducted on the example of Ukraine, considering its historical and economic context. According to the analysis of the local e-democracy index in Ukraine for 2018-2020, there has been a positive growth in most cities, with more than 70% growth rate in Ivano-Frankivsk, Ternopil, and Kyiv, but other cities such as Lviv, Odesa, and Kharkiv also have a fairly high average value of about 56-67%, indicating an improvement in the interaction and influence of citizens on local governance and development processes.

The study of the mechanisms of cooperation and coordination between different levels of government, considering global and local challenges, highlights the need to combine global and local initiatives to achieve sustainable and balanced economic development. In addition, the activity of citizens, manifested through appeals to local governments, indicates their interest and participation in resolving issues related to their lives and communities. Based on the results obtained, recommendations and strategies have been developed to improve the system of local economic development management. These findings can serve as a basis for further research and development of local

development policies, contributing to the formation of a sustainable and competitive environment for communities, considering their needs and resources.

The system of local economic development management is a critical topic for further study in light of current challenges and extraordinary circumstances. The development of effective partnership mechanisms between government institutions, business and civil society has proven to be a key factor in ensuring the sustainable and balanced development of local communities, especially in unforeseen situations such as martial law. Therefore, further study of this topic is of great importance for the adaptation of public initiatives and management decisions, ensuring the sustainable development of local communities in the face of uncertainty and difficulties.

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Conflict of Interest

None.

References

- [1] Annan-Aggrey, E., Arku, G., Atuoye, K., & Kyeremeh, E. (2022). Mobilizing 'communities of practice' for local development and acceleration of the Sustainable Development Goals. *Local Economy*, 37(3), 219-229. doi: [10.1177/02690942221101532](https://doi.org/10.1177/02690942221101532).
- [2] Catalinac, A., Bueno de Mesquita, B., & Smith, A. (2020). A tournament theory of pork barrel politics: The case of Japan. *Comparative Political Studies*, 53(10-11), 1619-1655. doi: [10.1177/0010414019897677](https://doi.org/10.1177/0010414019897677).
- [3] Fedorenko, T. (2023). Management and functional approaches to local economic development of communities. *Development Management*, 21(2), 39-47. doi: [10.57111/devt/2.2023.39](https://doi.org/10.57111/devt/2.2023.39).
- [4] Galunets, N. (2023). [Local economic development as a tool for the post-war reconstruction of territorial communities](#). In *Food security of Ukraine in the conditions of war and post-war recovery: Global and national dimensions* (pp. 328-331). Mykolaiv: Mykolaiv National Agrarian University.
- [5] Guibrunet, L., Gerritsen, P.R.W., Sierra-Huelsz, J.A., Flores-Díaz, A.C., García-Frapolli, E., García-Serrano, E., Pascual, U., & Balvanera, P. (2021). Beyond participation: How to achieve the recognition of local communities' value-systems in conservation? Some insights from Mexico. *People and Nature*, 3(3), 528-541. doi: [10.1002/pan3.10203](https://doi.org/10.1002/pan3.10203).
- [6] Haji, L., Valizadeh, N., & Hayati, D. (2020). The role of local communities in sustainable land and forest management. In *Spatial modeling in forest resources management* (pp. 473-503). Cham: Springer. doi: [10.1007/978-3-030-56542-8_20](https://doi.org/10.1007/978-3-030-56542-8_20).
- [7] Haudi, Aseh, K., Kenny, K., & Pathmathan, P.R. (2020a). Predictors that leads to socio economic success of local communities. *Archives of Business Review*, 8(11), 62-79. doi: [10.14738/abr.811.9271](https://doi.org/10.14738/abr.811.9271).
- [8] Haudi, Aseh, K., Kenny, K., & Pathmathan, P.R. (2020b). Success factors in achieving socio-economic development in local communities. *Archives of Business Research*, 8(11), 101-118. doi: [10.14738/abr.811.9275](https://doi.org/10.14738/abr.811.9275).
- [9] Huggins, R., Stuetzer, M., Obschonka, M., & Thompson, P. (2021). Historical industrialisation, path dependence and contemporary culture: The lasting imprint of economic heritage on local communities. *Journal of Economic Geography*, 21(6), 841-867. doi: [10.1093/jeg/lbab010](https://doi.org/10.1093/jeg/lbab010).
- [10] Information and analytical system for monitoring statistical and administrative indicators of territorial communities. (2023). Retrieved from <https://tdukr.maps.arcgis.com/apps/dashboards/7dddecfb77f14c9fad7268f6afe833d>.
- [11] Lamie, R.D., & Deller, S.C. (2020). *Local foods systems and community economic development*. London: Routledge. doi: [10.4324/9781003016151](https://doi.org/10.4324/9781003016151).
- [12] Local economic development: Models, resources and financing tools. (2020). Retrieved from https://decentralization.gov.ua/uploads/library/file/601/PLEDDG_LED_Finance_Guide_Part_1.pdf.
- [13] Loewe, M., Zintl, T., Fritzenkötter, J., Gantner, V., Kaltenbach, R., & Pohl, L. (2020). *Community effects of cash-for-work programmes in Jordan: Supporting social cohesion, more equitable gender roles and local economic development in contexts of flight and migration*. Bonn: German Institute of Development and Sustainability. doi: [10.23661/s103.2020](https://doi.org/10.23661/s103.2020).
- [14] Malizia, E., Feser, E.J., Renski, H., & Drucker, J. (2020). *Understanding local economic development*. Abingdon: Routledge.

- [15] Malyshivskiy, T.V., & Stefinin, V.V. (2021). Management of the economic development of the community through the prism of the concept of “local economic development”. *Scientific Bulletin of Odesa National Economic University*, 1(278), 66-75. doi: [10.32680/2409-9260-2021-1-2-278-279-66-75](https://doi.org/10.32680/2409-9260-2021-1-2-278-279-66-75).
- [16] Matveieva, O.Yu. (2021). The European paradigm of the sustainable development of territorial communities: Experience for Ukraine. *Bulletin of the National Academy of Public Administration under the President of Ukraine*, 1(100), 148-157. doi: [10.36030/2310-2837-1\(100\)-2021-148-157](https://doi.org/10.36030/2310-2837-1(100)-2021-148-157).
- [17] Pereira, J., Santos, M.J., & Rosalino, L.M. (2022). Role of local communities in the social network of the protected area management. *Conservation Science and Practice*, 4(5), article number e12664. doi: [10.1111/csp2.12664](https://doi.org/10.1111/csp2.12664).
- [18] Prykhodko, H., Yemelyanova, A., Loboyko, S., Khutkiy, D., & Kushnirenko, T. (2018). *Index of local e-democracy in Ukraine: A pilot study*. Retrieved from <https://cid.center/wp-content/uploads/2019/09/E-Dem-Index-2018.pdf>.
- [19] Patynska-Popeta, M., & Zinchuk, T. (2022). Prospective areas for managing the financial potential of sustainable development of territorial communities. *Scientific Horizons*, 25(11), 120-130. doi: [10.48077/scihor.25\(11\).2022.120-130](https://doi.org/10.48077/scihor.25(11).2022.120-130).
- [20] Rugeiyamu, R., Shayi, A., Kashonda, E., & Mohamed, B. (2021). [Role of local government authorities in promoting local economic development and service delivery to local community in Tanzania](#). *Local Administration Journal*, 14(2), 123-144.
- [21] Saleh, H., Surya, B., Annisa Ahmad, D.N., & Manda, D. (2020). The role of natural and human resources on economic growth and regional development: With discussion of open innovation dynamics. *Journal of Open Innovation: Technology, Market, and Complexity*, 6(4), article number 103. doi: [10.3390/joitmc6040103](https://doi.org/10.3390/joitmc6040103).
- [22] Siryk, Z., Popadynets, N., Pityulych, M., Chakii, O., Irtyshcheva, I., Panukhnyk, O., Hyk, V., Fedotova, Y., Rohozian, Y., & Lysyak, N. (2021). Decentralization of local self-government under the conditions of administrative-territorial reform in Ukraine. *Accounting*, 7, 781-790. doi: [10.5267/j.ac.2021.2.006](https://doi.org/10.5267/j.ac.2021.2.006).
- [23] Statistics Poland. (2023). Retrieved from <https://stat.gov.pl/en/international-statistics/>.
- [24] Statistics portal of Lithuania. (2023). Retrieved from https://osp.stat.gov.lt/statistiniu-rodikliu-analize?indicator=S8R549#.
- [25] Storonyanska, I., Dub, A., Graftska, O., Hrynchyshyn, I., Bilanyuk, O., & Pierscieniak, A. (2021). [The tourist infrastructure of local communities in Ukraine: Current state and impact on local economic development](#). *Agricultural and Resource Economics: International Scientific E-Journal*, 7(2), 102-118.
- [26] Tantoh, H.B., Simatele, D.M., Ebhuoma, E., Donkor, K., & McKay, T.J. (2021). Towards a pro-community-based water resource management system in Northwest Cameroon: Practical evidence and lessons of best practices. *GeoJournal*, 86, 943-961. doi: [10.1007/s10708-019-10085-3](https://doi.org/10.1007/s10708-019-10085-3).
- [27] Yemelyanova, A., & Loboyko, S. (2020). *Index of local electronic democracy in Ukraine*. Kyiv: Innovation Development Center.
- [28] Yemelyanova, A., Loboyko, S., & Mayevska, O. (2019). *Index of local electronic democracy in Ukraine*. Kyiv: Innovation Development Center.

Система управління місцевим економічним розвитком громад

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Анотація. У сучасних умовах стало важливим завданням підтримка та стимулювання місцевого економічного розвитку громад з метою поліпшення життєвого рівня населення та створення стійких та конкурентоспроможних громадських структур. Метою цього дослідження є вивчення системи управління місцевим економічним розвитком громад, що стає все більш актуальним завданням у контексті соціального, економічного та політичного розвитку сучасних суспільств. В результаті проведення дослідження було отримано такі результати: за допомогою високоякісних даних із видання *Local economic development: Models, resources and financing tools* розглянуто різні моделі та підходи до управління місцевим економічним розвитком громад, включаючи централізовані та децентралізовані системи, а також варіанти залучення громадян до прийняття рішень; за допомогою статистичних джерел Інформаційно-аналітичної системи моніторингу статистичних та адміністративних показників територіальних громад, Statistics Portal of Lithuania, Statistics Poland був проведений порівняльний аналіз систем управління місцевим розвитком громад в Україні, Польщі, Литви; було проаналізовано рівень участі громадян та стейкхолдерів у процесах прийняття рішень та розробці стратегій місцевого економічного розвитку; оцінено використання технологій для підвищення продуктивності місцевого економічного розвитку за допомогою ґрунтових досліджень з Центру розвитку інновацій; досліджено та порівняно механізми співпраці та координації між різними рівнями уряду з впливом чинників; проаналізовані територіальні громади за регіонами щодо звернення громадян з питань діяльності органів місцевого самоврядування за допомогою статистичних даних з сайту Державної установи “Урядовий контактний центр”; розроблені рекомендації та стратегії для вдосконалення системи управління місцевим економічним розвитком громад. Дослідження системи управління місцевим економічним розвитком громад має велику практичну значимість у сучасних умовах, де сприятливе економічне середовище на рівні місцевих громад є важливим чинником для поліпшення життєвого рівня населення та створення стійких та конкурентоспроможних громадських структур

Ключові слова: інфраструктура та інвестиції; партнерство між секторами; ефективність ресурсів; підвищення конкурентоспроможності

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