**European Journal of Sustainable Development Research**
2025, 9(4), em0315
e-ISSN: 2542-4742
https://www.ejosdr.com/

MODESTUM

**Research Article**

**OPEN ACCESS**

# Comprehensive human security assessment in sustainable regional development: Insights for innovation policy

Nataliia Biloshkurska [1*], Vitaliy Omelyanenko [2], Olha Yemets [3], Oksana Braslavska [4], Petro Matkovskyi [5], Olena Omelianenko [2,6], Tetiana Korniienko [1]

[1] Department of Marketing, Management, and Business Management, Pavlo Tychyna Uman State Pedagogical University, Uman, UKRAINE
[2] Sector of Innovation and Investment Problems of Industrial Development, Institute of Industrial Economics of NAS of Ukraine, Kyiv, UKRAINE
[3] Department of Entrepreneurship, Trade and Applied Economics, Vasyl Stefanyk Precarpathian National University, Ivano-Frankivsk, UKRAINE
[4] Department of Geography, Geodesy and Land Management, Pavlo Tychyna Uman State Pedagogical University, Uman, UKRAINE
[5] Department of Accounting and Taxation, Vasyl Stefanyk Precarpathian National University, Ivano-Frankivsk, UKRAINE
[6] Department of Business Economics and Administration, Sumy Makarenko State Pedagogical University, Sumy, UKRAINE
***Corresponding Author:** biloshkurska.n@udpu.edu.ua

**Citation:** Biloshkurska, N., Omelyanenko, V., Yemets, O., Braslavska, O., Matkovskyi, P., Omelianenko, O., & Korniienko, T. (2025). Comprehensive human security assessment in sustainable regional development: Insights for innovation policy. *European Journal of Sustainable Development Research, 9*(4), em0315. https://doi.org/10.29333/ejosdr/16572

**ARTICLE INFO**

Received: 10 Feb. 2025

Accepted: 13 Jun. 2025

**ABSTRACT**

The study assesses human security within sustainable regional development in Ukraine, focusing on calculating a human security index to compare economic, social, and environmental aspects of development. The methodology standardizes indicators to ensure objective evaluation and assigns weighting factors for the index. Analysis revealed significant regional disparities: Kyiv leads in economic stability, social well-being, and environmental responsibility, while Luhansk scores lowest due to socio-economic challenges. The economic component highlights the dependence of human security on income and stability, with Kyiv and Dnipro performing best. Social security is highest in Kyiv, reflecting better access to healthcare, education, and social protection, whereas Luhansk and Chernivtsi rank lowest. Environmentally, Kyiv and Dnipro lead due to significant investments in protection measures, while Western regions lag. The human security index reflects regional disparities and underscores the need for differentiated state strategies to address low-scoring regions through targeted investment and policy adjustments. Additionally, the index is a valuable tool for monitoring and evaluating sustainable development initiatives.

**Keywords:** human security, sustainable development, regional development, innovation policy, human security index

## INTRODUCTION

The relevance of sustainable regional development in the context of current global challenges is becoming increasingly important, especially for countries with a dynamic socio-economic context, such as Ukraine. Human security, as a component of sustainable development, reflects not only economic but also social and environmental stability, which provides a favorable environment for the development of society, reduction of inequality, and prevention of social conflicts. Identification and assessment of human security indicators at the regional level are important steps towards the formation of policies aimed at balanced regional development, strengthening social well-being and environmental sustainability.

This paper aims to comprehensively investigate the level of human security in sustainable regional development in Ukraine using statistical analysis of indicators standardized for individual regions. The main emphasis is placed on the calculation of weighting coefficients for each of the components: economic, social, and environmental, which allows us to determine the impact of each indicator on the overall level of human security. This approach provides a scientifically sound basis for constructing a human security index for sustainable regional development, which can be used to compare regions by their level of sustainable development.

In addition, an important component of the study is the analysis of correlations between different human security indicators, which allows us to identify the most and least interrelated indicators. This makes it possible not only to assess the current situation but also to develop recommendations for improving the economic, social, and environmental components of sustainable development in regions with low scores on certain indicators. For example, establishing a close link between economic activity and social

well-being allows us to identify priorities for investment in regions with low incomes and high unemployment.

In the context of Ukraine, which is facing internal and external challenges, such as armed conflict and economic crises, the issue of human security at the regional level is becoming even more relevant. The heterogeneity of socio-economic development in different regions and the environmental problems faced by the country necessitates the search for new methods of assessing and monitoring human security that will be able to consider all regional peculiarities and specific needs of the population. This study proposes the use of an integral approach to assessing human security, which can be a useful tool in developing a policy for sustainable regional development in Ukraine.

Thus, the study of the level of human security in the sustainable regional development of Ukraine is a relevant and promising area with significant scientific and practical potential. The results of the study can be used as a basis for further research and practical recommendations for improving regional policy in the context of sustainable development. It is expected that the proposed methodology for calculating weighting factors and constructing the human security index will contribute to a deeper understanding of sustainable development at the regional level and help to formulate a more effective regional policy that considers all components of human security.

While previous studies have examined the economic consequences of military conflicts, there remains a significant gap in understanding how full-scale wars specifically reshape labor markets, particularly in terms of employment disruptions and long-term unemployment trends. Existing research often focuses on localized conflicts or macroeconomic instability without fully capturing the structural shifts caused by large-scale warfare. This study aims to bridge this gap by analyzing the direct and indirect effects of military conflicts on labor market dynamics. The paper is structured as follows: We first review the relevant literature on war-related labor market transformations. We then outline the methodology used to assess employment shifts. After that we present the empirical findings. And finally, we discuss the broader implications and policy recommendations.

## LITERATURE REVIEW

Human security is a multidimensional concept that includes economic, food, environmental, and social security. Wali and Al-Najjar (2020) analyze the transition from the traditional security discourse focused on military threats during the Cold War to the concept of human security in the context of globalization. The authors emphasize that human security encompasses not only physical, but also economic, social, and environmental components, which makes it more relevant to modern challenges. They call for the integration of human security aspects into public policy to effectively address global crises. Owen (2008) emphasizes the importance of a multidimensional approach to measuring human security, as traditional indicators do not reflect all aspects that affect human well-being. Developing effective methods for assessing human security is a key task for researchers. Martin and Kostovicova (2013) note that it is important to create a methodology that can combine different aspects of human security, including social, economic, and environmental factors. This also confirms the importance of involving local communities in the assessment process. Lior et al. (2018) compare different methods of measuring sustainable development in Southeast Europe, highlighting the importance of integrating economic, social, and environmental priorities. They emphasize that sustainable development is not possible without considering human well-being. Indicators are critical to measuring sustainable development. Alaimo and Maggino (2020) address conceptual and methodological issues related to sustainable development indicators at the territorial level, emphasizing the need to adapt methods to specific local contexts. Rahma et al. (2019) present a composite indicator of regional sustainable development in Indonesia, demonstrating the importance of integrating economic, social, and environmental indicators into a single measurement framework.

Assessing well-being is an important part of human security research. Loveridge et al. (2020) propose a protocol for the selection of local well-being indicators, which can help to measure human security more accurately at the local level. Another important aspect is the use of composite indicators to measure human development, as discussed in Alaimo and Seri (2023). Gatto (2020) discusses a pluralistic approach to sustainable development, emphasizing the importance of a variety of indicators that can reflect the actual state of development of local communities. This confirms the need to consider social, economic, and environmental aspects in measuring well-being. Challenges related to social security are also an important aspect. Kharazishvili et al. (2020) examine social security in developing countries, using Ukraine as an example, pointing out the importance of indicators for assessing social security. This study emphasizes that social security should be integrated into sustainable development strategies.

Innovation plays a key role in achieving the sustainable development goals. Hickel's (2020) study draws attention to the ecological efficiency of human development in the Anthropocene, emphasizing the need for innovation to address modern environmental challenges. Also important is the approach to sustainable human resource management, which is discussed in an article by Anlesinya and Susomrith (2020). The authors offer a systematic review of human resource management in the context of sustainable development, which emphasizes the importance of integrating social aspects into development strategies. Developing policies that support innovation is essential for achieving sustainable development. The study by Parish et al. (2020) proposes an assessment framework for new methodological approaches to assessing human health safety. It emphasizes the importance of assessing risks and challenges in the context of new technologies and innovations (Biloshkurska et al., 2019; Ponomarenko et al., 2019).

Keković et al. (2023) point to the concept of resilience as a methodological approach to assessing human security in local communities. This demonstrates the need to develop strategies that would stimulate the development of resilience in the context of human security. In this context, resilience is

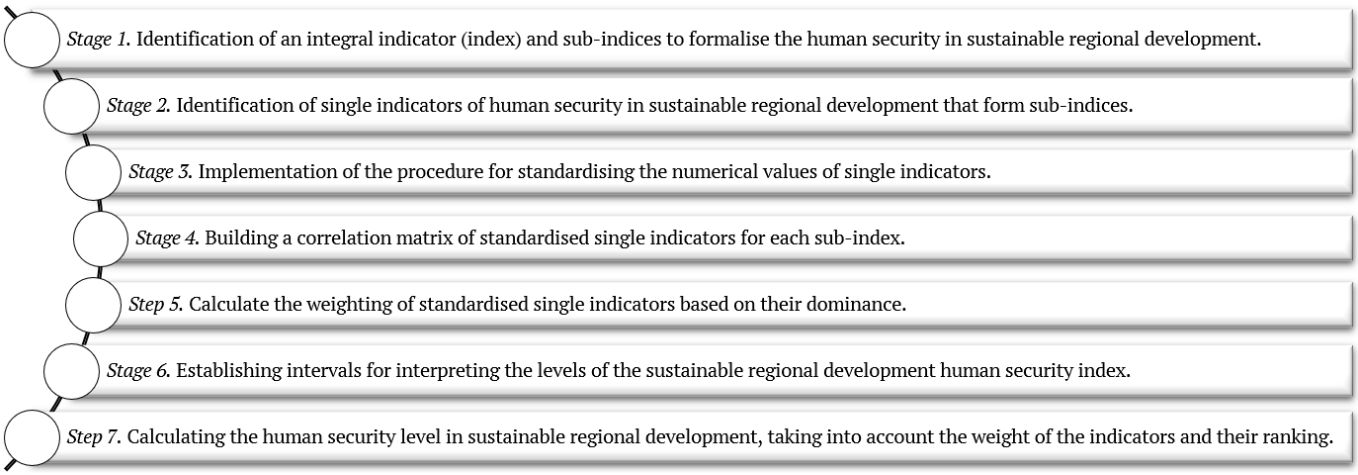


**Figure 1.** The sequence of development and implementation of the methodology for a comprehensive human security assessment in sustainable regional development (Source: Authors' own elaboration)

methodologically integrated into the human security assessment as both a measurable capacity and a dynamic process that enables individuals and communities to anticipate, absorb, and adapt to various shocks and stresses–environmental, economic, social, or political. Drawing on the framework proposed by Keković et al. (2023), resilience is not only an outcome but also a guiding principle that shapes the formulation of policies and practices aimed at achieving sustainable development. It serves as a bridge between immediate risk mitigation and long-term adaptability, thereby embedding sustainability within the human security paradigm. The study by Birkmann et al. (2022) highlights the importance of understanding climate change vulnerability for adaptation planning. It demonstrates how climate change affects human security and points to the need to integrate environmental indicators into development strategies. Roy et al. (2024) proposes a livelihood security approach to sustainable development, which aims to prioritize development in the context of local communities. This emphasizes the importance of considering local contexts when designing sustainable development strategies.

Recent studies have further expanded our understanding of the labor market consequences of military conflicts, particularly in the context of large-scale wars. For instance, Klopov and Ohrenych, (2024) examine post-war employment recovery trends, highlighting the uneven impact across different economic sectors. Similarly, Maksymenko et al. (2024) explore the role of digital transformation and remote work in mitigating war-induced job losses. Moreover, recent policy-oriented research, such as Davymuka and Popadynets (2024), underscores the necessity of government interventions in stabilizing labor markets during prolonged conflicts. Integrating these perspectives provides a more comprehensive framework for analyzing employment disruptions caused by military conflicts.

Therefore, the assessment of human security in the context of sustainable regional development is a complex process that requires the integration of various aspects and methods. The importance of a comprehensive approach to measuring human security is confirmed by current research. Innovations and community involvement in decision-making are key to ensuring sustainable development and improving human security. The issue of human security in sustainable regional development is related to several aspects that remain insufficiently studied in the scientific literature. Firstly, the complexity of this phenomenon requires a comprehensive approach that includes the assessment of economic, social, and environmental indicators. However, there is a certain scientific vacuum regarding the methods that could integrate these heterogeneous indicators into a single index capable of reflecting the level of human security in different regions. Secondly, the diversity of regional characteristics and imbalances in the distribution of resources create additional difficulties in formulating a sustainable development policy that would consider all the specific needs of the population and the capabilities of individual regions. In this regard, methods of standardizing indicators and building correlation matrices are important to more accurately reflect the interrelationships between different aspects of human security.

## METHODOLOGY

The methodology of comprehensive security assessment of sustainable regional development should be based on the concept of sustainable development, which combines economic, social, and environmental components (McNeill, 2007). Developing and implementing the methodology for a comprehensive security assessment of sustainable regional development is a logical process of sequential execution of methodological techniques and actions, which can be represented graphically (**Figure 1**).

Based on previous studies (Omelyanenko et al., 2021; Prokopenko et al., 2021), the comprehensive assessment is based on the formation of an integrated indicator (index) of sustainable development security as a geometric mean of 3 sub-indices:

$$I_{SRD_{HS}} = \sqrt[3]{\hat{I}_{EcC} \times \hat{I}_{SC} \times \hat{I}_{EnC}}, \quad (1)$$

where $I_{SRD_{HS}}$ is the sustainable regional development human security index, $\hat{I}_{EcC}$ is the sub-index of the economic component of sustainable regional development human

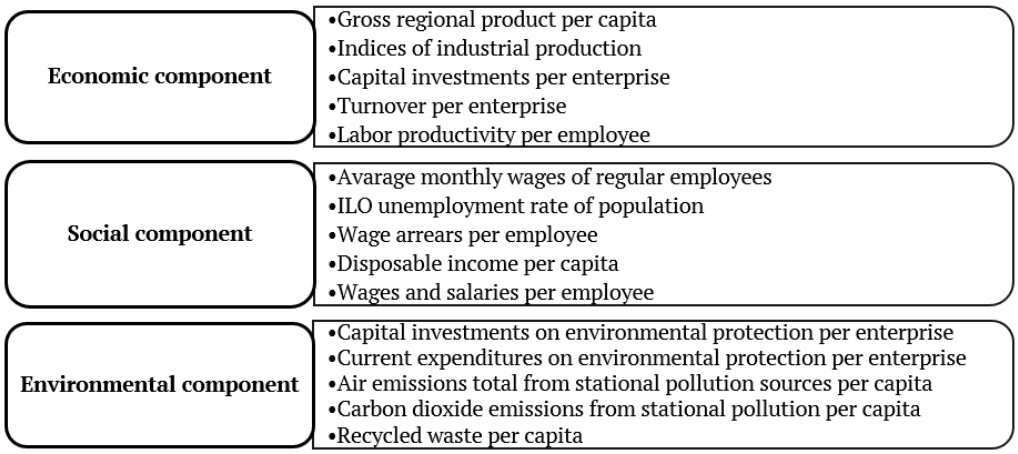


**Figure 2.** Systematization of single human security indicators in the context of sustainable regional development (Omelyanenko et al., 2019)

security, $\hat{I}_{SC}$ is the sub-index of the social component of sustainable regional development human security, and $\hat{I}_{EnC}$ is the sub-index of the environmental component of sustainable regional development human security.

The generalized fequation for the sub-index of the sustainable regional development component ( $\hat{I}_C$ ) is as follows:

$$\hat{I}_C = \sum_{j=1}^{m} w_{S_{C_{ij}}} S_{C_{ij}}, \quad (2)$$

where $w_{S_{C_{ij}}}$ is the $j$-th weighting for the standardized indicator $S_{C_{ij}}$ of the security component of sustainable regional development by the $i$-th region, $i$ is the sequence number of the region, $i$ = 1, 2, ..., $n$, $n$ is the number of regions, and $j$ is the sequence number of the indicator, $j$ = 1, 2, ..., $m$, $m$ is the number of individual indicators in the sub-index.

Single indicators of human security in sustainable regional development are summarized in **Figure 2**.

**Figure 2** systematizes five single indicators for each of the three components of the security index of sustainable regional development. It is clear that no restrictions are set for single indicators, their number and calculation methods are not regulated, but such indicators have already been tested (Omelyanenko et al., 2019), and our study is a continuation of this work. The selection of five single indicators for each component of the human security index, as presented in **Figure 2**, aligns with established statistical practices for constructing composite indices, such as those recommended by the Nardo et al. (2005), handbook on constructing composite indicators. This approach ensures a balanced representation of the economic, social, and environmental dimensions of sustainable regional development while maintaining parsimony and avoiding redundancy. These indicators were chosen to reflect key aspects of human security, building on prior validations (Omelyanenko et al., 2018, 2019) and providing a robust foundation for assessing regional disparities in Ukraine. In addition, an integrated assessment of the security of sustainable regional development in Ukraine will be carried out based on official statistics for 2010-2020 (**Appendix A**, **Appendix B**, and **Appendix C**) in the context of 24 regions with the capital Kyiv, excluding the temporarily occupied territories of the Autonomous Republic of Crimea and parts of Donetsk and Luhansk regions of Ukraine. This task is also solved in the dynamics, as statistical data for 11 years are processed, and average values are taken for the study.

The third stage of the methodology for a comprehensive assessment of human security in the context of sustainable regional development (see **Figure 1**) is to standardize the numerical values of the single indicators under study (see **Figure 2**). At the beginning of the standardization procedure, single indicators are subject to the determination of their impact on the security of sustainable regional development. For example, if the growth of indicators indicates the strengthening of human security in the context of sustainable regional development, such indicators are called incentives. If an increase in the indicators indicates a weakening of human security and the security of sustainable regional development, such indicators are called disincentives. After classifying the indicators by the direction of their impact on the security of sustainable development, we proceed directly to the standardization procedure, the essence of which is to bring the entire data set to a single measurement scale in the range [0; 1], where the worst numerical value is standardized as 0, and the best is assigned a value of 1, but within the aggregate of the values of each indicator. Mathematically, the standardization procedure for the incentives ($S_{C_{ij}}\uparrow$) indicator is implemented by the Eq. (3):

$$S_{C_{ij}}\uparrow = \frac{x_{ij} - x_{min_j}}{x_{max_j} - x_{min_j}}, \quad (3)$$

where $x_{ij}$ is the numerical value of the $j$-th single indicator of human security of sustainable development of the $i$-th region, which is being standardized, and $x_{min_j}$ and $x_{min_j}$ are, respectively, the smallest and largest numerical values of the $j$-th single indicator of the human dimension of sustainable regional development security.

According to Eq. (3), the highest numerical value of the incentive indicator will be 1, and the lowest value will be 0.

For disincentives ($S_{C_{ij}}\downarrow$), the standardization is based on the Eq. (4):

$$S_{C_{ij}}\downarrow = \frac{x_{max_j} - x_{ij}}{x_{max_j} - x_{min_j}}, \quad (4)$$

According to Eq. (4), the highest numerical value of the disincentive indicator will be 0, and the lowest will be 1.

The fourth stage of the methodology for a comprehensive assessment of human security in the context of sustainable regional development involves building a correlation matrix. This methodology involves calculating all the pairwise correlation coefficients between standardized single indicators using the Eq. (5):

$$r_{S_{C_{ij}}S_{C_j}} = \frac{cov\,(S_{C_{ij}} - S_{C_j})}{\sigma_{S_{C_{ij}}}\sigma_{S_{C_j}}}, \quad (5)$$

where $r_{S_{C_{ij}}S_{C_j}}$ is the Pearson pairwise correlation coefficient between the standardized single indicator $S_{C_{ij}}$ and any other standardized single indicator $S_{C_j}$, $cov\,(S_{C_{ij}} - S_{C_j})$ is the covariance for the standardized single indicator $S_{C_{ij}}$ and any other standardized single indicator $S_{C_j}$, $\sigma_{S_{C_{ij}}}$ is the standard deviation of the standardized single indicator $S_{C_{ij}}$, and $\sigma_{S_{C_j}}$ is the standard deviation of any other standardized single indicator $S_{C_j}$.

The correlation matrix summarizes all the values of the pairwise correlation coefficients calculated using the Eq. (5). You can also build a correlation matrix using the Excel function "data analysis ⇨ correlation".

The fifth stage of the methodology for the comprehensive assessment of human security in the context of sustainable regional development involves calculating the weighting coefficients of standardized single indicators within the sub-index. The principle of indicator dominance is necessarily considered (Prokopenko et al., 2019, pp. 388-389). That is, the indicator that is most closely related to the others has the greatest weight. Based on the principle of dominance, for example, the weighting of the first single indicator of the economic component of human security in sustainable regional development ($w_{S_{EcC_1}}$) is calculated by the Eq. (6):

$$w_{S_{EcC_1}} = \frac{\sum_{i=1}^{n}\left|r_{S_{EcC_{i1}}S_{EcC_{ij}}}\right|}{\sum_{j=1}^{m}\left|r_{S_{EcC_{ij}}S_{EcC_{i-1j}}}\right|}. \quad (6)$$

Eq. (6) calculates the weighting coefficient of a single indicator of the relevant component of human security in sustainable regional development according to the principle of dominance. The numerator of the equation represented by Eq. (6) is the sum of all pairwise correlation coefficients between the first standardized single indicator and the rest of the standardized indicators, and the denominator is the sum of all pairwise correlation coefficients of the correlation matrix. Accordingly, the indicator that correlates most strongly with the others has a higher weight.

The weighting coefficient of the second single indicator of the first component of human security in sustainable regional development is calculated by the Eq. (7):

**Table 1.** Levels of the sustainable regional development human security index (Prokopenko et al., 2019, p. 391)

| Integral index value | Security level characteristics | Threats |
|---|---|---|
| $I_{SRD_{HS}} \in [0.75; 1.00]$ | High | Minimal |
| $I_{SRD_{HS}} \in [0.50; 0.75)$ | Middle | Acceptable |
| $I_{SRD_{HS}} \in [0.25; 0.50)$ | Low | Significant |
| $I_{SRD_{HS}} \in [0.00; 0.25)$ | Critical | Maximal |

$$w_{S_{EcC_2}} = \frac{\sum_{i=1}^{n}\left|r_{S_{EcC_{i2}}S_{EcC_{ij}}}\right|}{\sum_{j=1}^{m}\left|r_{S_{EcC_{ij}}S_{EcC_{i-1j}}}\right|}. \quad (7)$$

The weighting coefficients of other single indicators of any component of human security in sustainable regional development are calculated similarly to those in Eq. (6) and Eq. (7).

The following criterion should be used to determine the correctness of calculations of the weighting coefficients of standardized single indicators of any component of human security in sustainable regional development:

$$\sum_{j=1}^{m} w_{S_{C_j}} = 1. \quad (8)$$

To set the levels of the human security index for sustainable regional development, we should proceed with the following constraints:

$$0 \leq I_{SRD_{HS}} \leq 1. \quad (9)$$

Thus, according to Eq. (9), the sustainable regional development human security index can take numerical values from 0 to 1, and to determine its levels, we will use the source (Prokopenko et al., 2019, p. 391) (**Table 1**).

The data in **Table 1** are similarly used to rank the levels of human security by the components of sustainable regional development–economic, social, and environmental. At the same time, for an adequate and reliable interpretation of the human security index of sustainable regional development, the 4 levels described in **Table 1** are quite sufficient. Thus, at a high level, the impact of threats to human security is minimal and does not significantly affect the disruption of sustainable regional development. At the medium level, the existing threats to human security can be considered acceptable, but their impact on sustainable development is significant and therefore requires urgent municipal decisions. At the low level, threats to human security are considered significant, and their impact on sustainable regional development is considered destructive and requires urgent municipal action to stabilize the situation. The critical level is characterized by the maximum impact of all existing threats to human security, which are catastrophic for sustainable regional development. But in any case, it is necessary to analyze in detail the causes and consequences of the destructive impact of threats on the level of human security of sustainable regional development.

**Table 2.** Standardized indicators of the economic component of sustainable regional development human security index (by the example of Ukraine's regions)

| Region | $S_{EcC1\uparrow}$* | $S_{EcC2\uparrow}$ | $S_{EcC3\uparrow}$ | $S_{EcC4\uparrow}$ | $S_{EcC5\uparrow}$ |
|---|---|---|---|---|---|
| Cherkasy | 0.176 | 0.681 | 0.133 | 0.388 | 0.399 |
| Chernihiv | 0.148 | 0.517 | 0.247 | 0.261 | 0.206 |
| Chernivtsi | 0.042 | 0.587 | 0.030 | 0.000 | 0.024 |
| City of Kyiv | 1.000 | 0.547 | 0.749 | 0.984 | 1.000 |
| Dnipropetrovsk | 0.342 | 0.665 | 0.728 | 0.874 | 0.578 |
| Donetsk | 0.116 | 0.414 | 0.726 | 1.000 | 0.454 |
| Ivano-Frankivsk | 0.115 | 0.731 | 0.314 | 0.148 | 0.296 |
| Kharkiv | 0.218 | 0.652 | 0.000 | 0.248 | 0.251 |
| Kherson | 0.099 | 0.682 | 0.020 | 0.048 | 0.162 |
| Khmelnytskyi | 0.118 | 0.643 | 0.428 | 0.188 | 0.182 |
| Kirovohrad | 0.153 | 0.884 | 0.064 | 0.176 | 0.293 |
| Kyiv | 0.320 | 0.778 | 1.000 | 0.601 | 0.579 |
| Luhansk | 0.000 | 0.000 | 0.239 | 0.260 | 0.000 |
| Lviv | 0.167 | 0.766 | 0.355 | 0.312 | 0.258 |
| Mykolaiv | 0.173 | 0.755 | 0.079 | 0.187 | 0.372 |
| Odesa | 0.185 | 0.677 | 0.017 | 0.226 | 0.373 |
| Poltava | 0.351 | 0.660 | 0.800 | 0.617 | 0.437 |
| Rivne | 0.091 | 0.807 | 0.219 | 0.163 | 0.124 |
| Sumy | 0.135 | 0.624 | 0.243 | 0.279 | 0.155 |
| Ternopil | 0.073 | 0.796 | 0.430 | 0.280 | 0.291 |
| Vinnytsia | 0.156 | 0.893 | 0.427 | 0.289 | 0.275 |
| Volyn | 0.116 | 0.813 | 0.494 | 0.597 | 0.515 |
| Zakarpattia | 0.055 | 0.712 | 0.148 | 0.080 | 0.109 |
| Zaporizhzhia | 0.226 | 0.660 | 0.114 | 0.384 | 0.318 |
| Zhytomyr | 0.121 | 1.000 | 0.192 | 0.202 | 0.135 |

Note. *$S_{\uparrow}$ means that the standardized single indicator is an incentive (compiled & calculated using Eq. [1] and Eq. [2] based on the data in **Appendix A**)

**Table 3.** Matrix of pairwise correlation coefficients between standardized indicators of the economic component of sustainable regional development human security index in Ukrainian regions

| | $S_{EcC1}$ | $S_{EcC2}$ | $S_{EcC3}$ | $S_{EcC4}$ | $S_{EcC5}$ |
|---|---|---|---|---|---|
| $S_{EcC1}$ | 1 | | | | |
| $S_{EcC2}$ | -0.0132 | 1 | | | |
| $S_{EcC3}$ | 0.5000 | -0.0586 | 1 | | |
| $S_{EcC4}$ | 0.6507 | -0.2044 | 0.8000 | 1 | |
| $S_{EcC5}$ | 0.8542 | 0.0892 | 0.6535 | 0.8238 | 1 |

Note. Compiled & calculated using Excel based on the data in **Table 2**

## RESULTS AND DISCUSSION

The calculation of the level of human security in sustainable regional development, considering the weight of individual indicators, is the final 7th stage of the methodology for a comprehensive assessment of human security in sustainable regional development, the implementation of which is based on the statistical data of **Appendix A**, **Appendix B**, and **Appendix C** and Eq. (1)-Eq. (9).

Thus, guided by **Figure 2**, we first standardize the human security indicators in each component of sustainable regional development using the example of Ukrainian regions and build the corresponding correlation matrices. In this way, we lay the groundwork for calculating all the necessary weighting factors and constructing the human security index for sustainable regional development in Ukraine. The results of standardizing the indicators of the economic component of human security are summarized in **Table 2**, and the correlation matrix is presented in **Table 3**.

The data in **Table 2** indicate that, based on the aggregate of standardized values of single indicators, Luhansk Region ranks lowest in the economic component of human security of sustainable regional development, with its average annual values of GDP per capita, industrial production index, and labor productivity per employee being the lowest among Ukrainian regions analyzed. This assessment reflects data from 2010-2020, a period that includes the onset of armed conflict in parts of Luhansk starting in 2014. While the methodology standardizes indicators to ensure comparability across regions, it does not explicitly adjust for war-related distortions, such as disruptions to economic activity caused by the conflict. Consequently, Luhansk's low scores may partly reflect these external factors. In contrast, Kharkiv Region ranks lowest in average annual capital investment per enterprise, and Chernivtsi Region in turnover per enterprise, highlighting distinct regional challenges. The capital Kyiv was the absolute leader in terms of average annual GDP per capita and labor productivity per employee, and ranked second in terms of turnover per enterprise, behind Donetsk Region. Zhytomyr Region was the leader in terms of industrial production index growth, while Kyiv Region took the lead in terms of capital investment per enterprise.

Based on the data in **Table 2**, we build a correlation matrix using the correlation function in Excel (**Table 3**).

Based on the numerical values of the pairwise correlation coefficients presented in **Table 3**, it can be concluded that the strongest stochastic relationship exists between capital investment per enterprise and turnover per enterprise (0.8), turnover per enterprise and labor productivity per employee (0.82), GDP per capita and labor productivity per employee (0.85). At the same time, the weakest stochastic relationship is between the industrial production Index and: labor productivity per worker (0.09), capital investment per enterprise (0.06), and GDP per capita (0.01).

The results of the standardization of the indicators of the social component of human security are summarized in **Table 4**, and the correlation matrix is presented in **Table 5**.

The data in **Table 4** reveal that the city of Kyiv leads in the social component of human security of sustainable regional development in Ukraine, with the highest average annual values for standardized indicators including average monthly wages of regular employees, disposable income per capita, and wages and salaries per employee, alongside the lowest ILO unemployment rate and wage arrears per employee among all regions analyzed. This dominance likely reflects Kyiv's urban economic advantages, such as higher wage opportunities and labor market stability, which may not be representative of rural areas within the broader Kyiv Region or other parts of Ukraine. This urban-rural disparity represents a potential limitation, as the methodology aggregates data at the regional level and does not account for intra-regional variations in social conditions. Conversely, Luhansk Region exhibits the lowest social security scores across these indicators, followed by Chernivtsi Region, highlighting stark regional disparities.

**Table 4.** Standardized indicators of the social component of sustainable regional development human security index (by the example of Ukraine's regions)

| Region | $S_{SC1\uparrow}$* | $S_{SC2\uparrow}$ | $S_{SC3\uparrow}$ | $S_{SC4\uparrow}$ | $S_{SC5\uparrow}$ |
|---|---|---|---|---|---|
| Cherkasy | 0.088 | 0.417 | 0.864 | 0.181 | 0.197 |
| Chernihiv | 0.025 | 0.171 | 0.914 | 0.197 | 0.140 |
| Chernivtsi | 0.008 | 0.545 | 1.000 | 0.114 | 0.000 |
| City of Kyiv | 1.000 | 1.000 | 0.977 | 1.000 | 1.000 |
| Dnipropetrovsk | 0.323 | 0.785 | 0.921 | 0.380 | 0.501 |
| Donetsk | 0.460 | 0.052 | 0.543 | 0.110 | 0.433 |
| Ivano-Frankivsk | 0.100 | 0.662 | 0.931 | 0.163 | 0.186 |
| Kharkiv | 0.145 | 0.965 | 0.746 | 0.256 | 0.194 |
| Kherson | 0.025 | 0.362 | 0.894 | 0.175 | 0.034 |
| Khmelnytskyi | 0.075 | 0.510 | 0.955 | 0.193 | 0.143 |
| Kirovohrad | 0.052 | 0.225 | 0.809 | 0.180 | 0.106 |
| Kyiv | 0.337 | 0.945 | 0.842 | 0.301 | 0.571 |
| Luhansk | 0.158 | 0.000 | 0.000 | 0.000 | 0.035 |
| Lviv | 0.151 | 0.782 | 0.870 | 0.227 | 0.261 |
| Mykolaiv | 0.240 | 0.509 | 0.714 | 0.222 | 0.314 |
| Odesa | 0.179 | 0.991 | 0.943 | 0.274 | 0.231 |
| Poltava | 0.211 | 0.217 | 0.931 | 0.270 | 0.372 |
| Rivne | 0.121 | 0.259 | 0.927 | 0.159 | 0.148 |
| Sumy | 0.081 | 0.463 | 0.423 | 0.229 | 0.244 |
| Ternopil | 0.000 | 0.179 | 0.942 | 0.120 | 0.149 |
| Vinnytsia | 0.112 | 0.362 | 0.959 | 0.220 | 0.273 |
| Volyn | 0.048 | 0.324 | 0.939 | 0.140 | 0.191 |
| Zakarpattia | 0.117 | 0.449 | 0.963 | 0.096 | 0.252 |
| Zaporizhzhia | 0.287 | 0.542 | 0.838 | 0.322 | 0.402 |
| Zhytomyr | 0.055 | 0.221 | 0.943 | 0.194 | 0.198 |

Note. *$S_{\uparrow}$ means that the standardized single indicator is an incentive (compiled and calculated using Eq. [1] and Eq. [2] based on the data in **Appendix B**)

**Table 5.** Matrix of pairwise correlation coefficients between standardized indicators of the social component of sustainable development human security index in Ukrainian regions

| | $S_{SC1}$ | $S_{SC2}$ | $S_{SC3}$ | $S_{SC4}$ | $S_{SC5}$ |
|---|---|---|---|---|---|
| $S_{SC1}$ | 1 | | | | |
| $S_{SC2}$ | 0.4184 | 1 | | | |
| $S_{SC3}$ | -0.0300 | 0.3319 | 1 | | |
| $S_{SC4}$ | 0.8419 | 0.5935 | 0.2869 | 1 | |
| $S_{SC5}$ | 0.9276 | 0.4916 | 0.1448 | 0.8584 | 1 |

Note. Compiled & calculated using Excel based on the data in **Table 4**

Based on the numerical values of the pairwise correlation coefficients presented in **Table 5**, it can be concluded that the tightest stochastic relationship exists between the average monthly wage of full-time employees and disposable income per capita (0.84), disposable income per capita and labor costs per employee (0.86), and the average monthly wage of full-time employees and labor costs per employee (0.93). At the same time, the weakest stochastic relationship is between wage arrears per employee and: the ILO unemployment rate (0.33), disposable income per capita (0.29), labor costs per employee (0.14), and disposable income per capita (-0.03).

The results of the standardization of the indicators of the environmental component of human security are summarized in **Table 6**, and the correlation matrix is presented in **Table 7**.

The results of the analysis of the standardized average values of the indicators of the environmental component of human security of sustainable regional development in Ukraine for 2010-2020, presented in **Table 6**, indicate that

**Table 6.** Standardized indicators of the environmental component of sustainable regional development human security index (by the example of Ukraine's regions)

| Region | $S_{EnC1\uparrow}$ | $S_{EnC2\uparrow}$ | $S_{EnC3\downarrow}$ | $S_{EnC4\downarrow}$* | $S_{EnC5\uparrow}$ |
|---|---|---|---|---|---|
| Cherkasy | 0.019 | 0.111 | 0.822 | 0.779 | 0.024 |
| Chernihiv | 0.037 | 0.208 | 0.870 | 0.847 | 0.004 |
| Chernivtsi | 0.025 | 0.082 | 1.000 | 0.998 | 0.003 |
| City of Kyiv | 0.039 | 0.094 | 0.970 | 0.804 | 0.000 |
| Dnipropetrovsk | 0.411 | 1.000 | 0.055 | 0.125 | 1.000 |
| Donetsk | 0.411 | 0.593 | 0.000 | 0.000 | 0.072 |
| Ivano-Frankivsk | 0.126 | 0.197 | 0.431 | 0.164 | 0.015 |
| Kharkiv | 0.070 | 0.157 | 0.835 | 0.674 | 0.004 |
| Kherson | 0.000 | 0.039 | 0.976 | 0.983 | 0.002 |
| Khmelnytskyi | 0.022 | 0.126 | 0.954 | 0.837 | 0.011 |
| Kirovohrad | 0.015 | 0.061 | 0.957 | 0.913 | 0.386 |
| Kyiv | 1.000 | 0.151 | 0.801 | 0.686 | 0.007 |
| Luhansk | 0.126 | 0.607 | 0.595 | 0.507 | 0.035 |
| Lviv | 0.041 | 0.082 | 0.843 | 0.877 | 0.005 |
| Mykolaiv | 0.054 | 0.379 | 0.953 | 0.835 | 0.003 |
| Odesa | 0.009 | 0.070 | 0.962 | 0.906 | 0.001 |
| Poltava | 0.091 | 0.439 | 0.846 | 0.811 | 0.083 |
| Rivne | 0.032 | 0.313 | 0.973 | 0.886 | 0.002 |
| Sumy | 0.029 | 0.310 | 0.923 | 0.868 | 0.008 |
| Ternopil | 0.019 | 0.000 | 0.965 | 0.960 | 0.006 |
| Vinnytsia | 0.035 | 0.076 | 0.728 | 0.650 | 0.008 |
| Volyn | 0.014 | 0.113 | 0.990 | 0.962 | 0.002 |
| Zakarpattia | 0.009 | 0.093 | 0.990 | 1.000 | 0.000 |
| Zaporizhzhia | 0.277 | 0.586 | 0.565 | 0.201 | 0.052 |
| Zhytomyr | 0.006 | 0.065 | 0.969 | 0.957 | 0.002 |

Note. $S_{\downarrow}$ means that the standardized single indicator is a disincentive (compiled and calculated using Eq. [1] and Eq. [2] based on the data in **Appendix C**)

**Table 7.** Matrix of pairwise correlation coefficients between standardized indicators of the environmental component of sustainable regional development human security index in Ukrainian regions

| | $S_{EnC1}$ | $S_{EnC2}$ | $S_{EnC3}$ | $S_{EnC4}$ | $S_{EnC5}$ |
|---|---|---|---|---|---|
| $S_{EnC1}$ | 1 | | | | |
| $S_{EnC2}$ | 0.3929 | 1 | | | |
| $S_{EnC3}$ | -0.4987 | -0.7701 | 1 | | |
| $S_{EnC4}$ | -0.5066 | -0.7344 | 0.9473 | 1 | |
| $S_{EnC5}$ | 0.2590 | 0.6257 | -0.5476 | -0.4141 | 1 |

Note. Compiled & calculated using Excel based on the data in **Table 6**

regional environmental policy in Ukraine is generally in a state of neglect.

Capital investment in environmental protection per enterprise varied widely, ranging from UAH 816 in Kherson Region to UAH 170.9 thousand in Kyiv region, with a national average of UAH 20.7 thousand. However, in 64% of Ukraine's regions, this investment did not exceed UAH 10,000 per enterprise. The situation with waste disposal is even more concerning: in 80% of Ukraine's regions, the average annual volume of waste disposal was below 1 ton, ranging from 5.7 kg in Kyiv to 925 kg in Luhansk Region. In contrast, Zaporizhzhia Region averaged 1.4 tons, Donetsk Region 1.9 tons, Poltava Region 2.2 tons, Kirovohrad Region 10.3 tons, and Dnipro Region 26.7 tons. For regions like Luhansk and Donetsk, affected by conflict since 2014, data gaps were addressed by using pre-conflict values (2010-2013) from the State Statistics Service of Ukraine (2024) and averaging them across the 2010-

**Table 8.** Calculation of the weighting coefficients of standardized indicators of the components of the sustainable regional development human security index of Ukraine

| | $\sum_{i=1}^{5}\left\lvert r_{S_{EcC_{i1}}S_{EcC_{ij}}}\right\rvert$ | $w_{S_{EcC_i}}$ | $\sum_{i=1}^{5}\left\lvert r_{S_{SC_{i2}}S_{SC_{ij}}}\right\rvert$ | $w_{S_{SC_i}}$ | $\sum_{i=1}^{5}\left\lvert r_{S_{EnC_{i3}}S_{EnC_{ij}}}\right\rvert$ | $w_{S_{EnC_i}}$ |
|---|---|---|---|---|---|---|
| $S_{C_{1j}}$ | 2.018111 | 0.217106 | 2.217887 | 0.225169 | 1.657205 | 0.145457 |
| $S_{C_{2j}}$ | 0.365509 | 0.039321 | 1.835296 | 0.186327 | 2.523228 | 0.221470 |
| $S_{C_{3j}}$ | 2.012145 | 0.216464 | 0.793629 | 0.080572 | 2.763699 | 0.242577 |
| $S_{C_{4j}}$ | 2.478990 | 0.266687 | 2.580690 | 0.262002 | 2.602478 | 0.228426 |
| $S_{C_{5j}}$ | 2.420756 | 0.260422 | 2.422383 | 0.245930 | 1.846463 | 0.162069 |
| $\sum_{j=1}^{3}\left\lvert r_{S_{C_{ij}}S_{C_{i-1j}}}\right\rvert$ | 9.295511 | 1.000000 | 9.849885 | 1.000000 | 11.393070 | 1.000000 |

Note. Compiled and calculated using Eq. (6), Eq. (7), and Eq. (8) based on the data in **Table 3**, **Table 5**, and **Table 7**

2020 period, as outlined before. While this ensures consistency in standardization, it may not fully reflect post-conflict environmental conditions, posing a limitation to the analysis.

The Ternopil Region was the outsider in terms of current environmental protection expenditures per enterprise, while the flagship was Dnipro. Donetsk Region was characterized by the highest volumes of air pollutant emissions from stationary sources per capita (253.6 kg) and carbon dioxide emissions from stationary sources per capita (9.7 tons), while Dnipro was the second with 239.9 kg of air pollutant emissions from stationary sources per capita and 8.5 tons of carbon dioxide emissions from stationary sources per capita. The lowest air pollutant emissions from stationary sources per capita and carbon dioxide emissions from stationary sources per capita in 2010-2020 were in the western regions of Ukraine–Zakarpattia, Volyn, and Chernivtsi.

The data in **Table 7** show that among the human security indicators in the environmental component of the security of sustainable regional development of Ukraine, the densest stochastic relationship is between current environmental protection expenditures per enterprise and carbon dioxide emissions from stationary sources of pollution per capita (0.73), as well as air pollutant emissions from stationary sources of pollution per capita (0.77). At the same time, the highest level of stochastic correlation density is observed between air pollutant emissions from stationary sources of pollution per capita and carbon dioxide emissions from stationary sources of pollution per capita (0.95). At the same time, the weakest stochastic relationship is between capital investment in environmental protection per enterprise and: current environmental protection expenditures per enterprise (0.39), and waste disposal per capita (0.26).

**Table 8** summarizes the results of the calculation of the weighting coefficients of the standardized human security indicators by the components of sustainable regional development in Ukraine. This is the result of step 5 of the methodology for the comprehensive assessment of human security in sustainable regional development (see **Figure 1**).

As can be seen from **Table 8**, when calculating the weighting coefficients of the indicators of each component, the principle of equality of the weighting coefficients of 1 was observed (see Eq. [8]). It has also been found that the index of industrial production for the year (3.9%) has the least impact on the economic component of the human security index in the context of sustainable regional development of Ukraine, while the volume of products sold per enterprise per year (26.7%) has the greatest impact. As for the social component of the human security index of sustainable regional development, the lowest impact is made by wage arrears per 1 employee (8.1%), and the highest impact is made by disposable income per 1 person. The environmental component is dominated by the indicator of air pollutant emissions from stationary sources per capita per year (24.3%), while the lowest impact is caused by capital investments in environmental protection per enterprise per year.

Using the weighting factors, the sub-indices and the human security index of sustainable regional development of Ukraine were calculated and the regions were ranked, the results are summarized in **Table 9**.

**Table 9** is the result of calculating the level of human security in the sustainable development of Ukraine's regions using index analysis and modelling. This index includes three sub-indices: economic, social and environmental, which indicate the level of human security in various aspects of sustainable development of regions. The human security index for Sustainable Development is the average of the three sub-indices and indicates the overall level of development and security of a region in terms of economic stability, social well-being and environmental sustainability. The highest index scores are observed in Kyiv (0.743), which also has the highest rank in all components, indicating the capital's leadership in sustainable development. Among other regions, Dnipropetrovsk (0.544), Kyiv (0.564), and Poltava (0.453) regions demonstrate high scores, which indicates their relative stability and high level of development.

The economic component of human security reflects economic stability and the ability of a region to provide an adequate standard of living for its population (Biloshkurska, 2010). The highest value of the economic sub-index is observed in Kyiv (0.924), which is significantly higher than in other regions. This can be explained by the concentration of economic resources, business, and investment in the capital. Among the other regions, Dnipropetrovsk (0.642), Kyiv (0.628), and Poltava (0.554) regions have high values, which indicates the relative economic stability of these regions. On the other hand, Chernivtsi (0.045), Luhansk (0.121), Zakarpattia (0.122), and Kherson (0.108) regions have the lowest values of the economic sub-index, indicating problems with economic sustainability and low-income levels in these regions.

**Table 9.** Formation of a comprehensive human security index for sustainable development of Ukrainian regions

| Region | $\hat{I}_{EcC}$ | | $\hat{I}_{SC}$ | | $\hat{I}_{EnC}$ | | $\hat{I}_{SRD_{HS}}$ | |
|---|---|---|---|---|---|---|---|---|
| | Value | Rank | Value | Rank | Value | Rank | Value | Rank |
| Cherkasy | 0.3012 | 8 | 0.2631 | 15 | 0.4085 | 20 | 0.3187 | 11 |
| Chernihiv | 0.2291 | 15 | 0.1969 | 22 | 0.4567 | 15 | 0.2741 | 18 |
| Chernivtsi | 0.0449 | 25 | 0.2140 | 20 | 0.4929 | 7 | 0.1680 | 24 |
| City of Kyiv | 0.9235 | 1 | 0.9981 | 1 | 0.4454 | 17 | 0.7432 | 1 |
| Dnipropetrovsk | 0.6416 | 2 | 0.5161 | 3 | 0.4852 | 10 | 0.5436 | 3 |
| Donetsk | 0.5837 | 4 | 0.2923 | 12 | 0.2027 | 25 | 0.3258 | 10 |
| Ivano-Frankivsk | 0.2384 | 13 | 0.3093 | 10 | 0.2066 | 24 | 0.2479 | 22 |
| Kharkiv | 0.2043 | 19 | 0.3875 | 6 | 0.4020 | 21 | 0.3169 | 13 |
| Kherson | 0.1078 | 24 | 0.1994 | 21 | 0.4702 | 11 | 0.2163 | 23 |
| Khmelnytskyi | 0.2410 | 12 | 0.2746 | 13 | 0.4556 | 16 | 0.3113 | 14 |
| Kirovohrad | 0.2052 | 18 | 0.1918 | 23 | 0.5189 | 2 | 0.2733 | 20 |
| Kyiv | 0.6276 | 3 | 0.5391 | 2 | 0.5311 | 1 | 0.5643 | 2 |
| Luhansk | 0.1211 | 23 | 0.0442 | 25 | 0.4185 | 19 | 0.1308 | 25 |
| Lviv | 0.2934 | 9 | 0.3735 | 7 | 0.4298 | 18 | 0.3611 | 6 |
| Mykolaiv | 0.2312 | 14 | 0.3417 | 8 | 0.5142 | 4 | 0.3437 | 9 |
| Odesa | 0.2278 | 16 | 0.4295 | 4 | 0.4574 | 13 | 0.3550 | 7 |
| Poltava | 0.5538 | 5 | 0.3252 | 9 | 0.5144 | 3 | 0.4525 | 4 |
| Rivne | 0.1750 | 21 | 0.2283 | 19 | 0.5127 | 5 | 0.2736 | 19 |
| Sumy | 0.2211 | 17 | 0.2585 | 16 | 0.4962 | 6 | 0.3050 | 15 |
| Ternopil | 0.2905 | 10 | 0.1772 | 24 | 0.4570 | 14 | 0.2865 | 16 |
| Vinnytsia | 0.3102 | 7 | 0.2947 | 11 | 0.3484 | 23 | 0.3170 | 12 |
| Volyn | 0.4574 | 6 | 0.2306 | 17 | 0.4874 | 9 | 0.3718 | 5 |
| Zakarpattia | 0.1217 | 22 | 0.2746 | 14 | 0.4907 | 8 | 0.2541 | 21 |
| Zaporizhzhia | 0.2847 | 11 | 0.4161 | 5 | 0.3615 | 22 | 0.3499 | 8 |
| Zhytomyr | 0.1963 | 20 | 0.2292 | 18 | 0.4692 | 12 | 0.2764 | 17 |

Note. Compiled and calculated using Eq. (1) and Eq. (2) based on the data in **Table 2**, **Table 4**, **Table 6**, and **Table 8**

The social component of the index reflects human security and social protection of the population, including access to healthcare, education, and social programs (Serohin et al., 2023). The highest values of the social sub-index are observed in Kyiv (0.998), which indicates the high quality of social services and their accessibility. Other leaders in the social sub-index include Kyiv (0.539), Dnipro (0.516), Odesa (0.430), and Zaporizhzhia (0.416) regions, which indicates a relatively high level of social infrastructure in these regions. Luhansk (0.044), Ternopil (0.177), Kherson (0.199), and Chernihiv (0.197) regions have the lowest scores, which may indicate insufficient provision of or limited access to social services.

The environmental component of human security indicates the level of environmental sustainability and the presence of environmental risks (Serohin et al., 2023). Kyiv Region has the highest score (0.5311), which indicates a relatively favorable environmental situation or effective environmental protection measures. Other regions with high scores include Kirovohrad (0.519), Poltava (0.514), and Rivne (0.513), which reflects their efforts to maintain environmental sustainability. In contrast, Donetsk (0.203), Ivano-Frankivsk (0.207), and Luhansk (0.419) regions have the lowest scores on the environmental sub-index, which may indicate environmental challenges related to industrial production, military operations, or other factors.

In general, the capital of Ukraine, Kyiv, as well as regions such as Kyiv, Dnipro and Poltava regions, demonstrate the most comprehensive development in terms of human security of sustainable development, with high scores in all sub-indices. This can be explained by the developed economies, significant budget funding and high level of infrastructure services in these regions. At the same time, some regions, such as Luhansk, Kherson, and Chernivtsi regions, have low scores in both the overall human security index and individual sub-indices. This reflects their socio-economic problems, limited resources, and insufficient investment in infrastructure and services.

Thus, the analysis of the comprehensive human security index of sustainable development of Ukraine's regions reveals significant differences between the regions in three key aspects: economic, social, and environmental. The highest indicators of stability and development are demonstrated by the capital (Kyiv), as well as Kyiv, Dnipro, and Poltava regions, which indicates the concentration of resources, developed infrastructure, and significant investments in economic, social, and environmental development. At the same time, regions such as Luhansk, Kherson, Chernivtsi, and other low-scoring regions face significant socio-economic challenges that limit their potential for sustainable development. Of particular concern is the situation in the regions affected by the hostilities, such as Donetsk and Luhansk regions, which have the lowest human security index scores due to destroyed infrastructure, low economic activity, and deteriorating environmental conditions. In addition, regions with low scores on the social sub-index, such as Luhansk, Ternopil, and Kherson, require increased humanitarian support and the development of social programs to ensure basic needs and access to services. The environmental situation in some regions, particularly in Donetsk and Luhansk regions, also requires increased attention. Poor environmental performance in these regions may be the result of active industrial activity and hostilities, which creates additional challenges for sustainable development and the safety of the population.

Based on the results of a comprehensive assessment of human security in the context of sustainable regional development, several recommendations can be made to improve the effectiveness of the state's innovative policy, in particular:

1. Expand innovation programs to support depressed regions, as regions with a low economic sub-index need to create special innovation programs to stimulate economic growth. These could include technology parks, grants for small business development, incentives for local innovative start-ups, and retraining programs. It is also important to develop digital tools to support entrepreneurship, which will create new jobs and attract investment. In addition, both individual entrepreneurs and small and medium-sized businesses can apply for such programs, provided they can justify the need to finance innovative initiatives to intensify their business activities. To combat the problem of low employment, it is necessary to introduce vocational training programs to help residents acquire new skills in demand in the labor market, including training in IT, green technologies, business management, and other innovative fields.
2. Stimulate social innovation policy to improve human security, especially for regions with low social indicators. Here, innovative solutions should be introduced to improve the quality of life of the population, including the massive introduction of digital platforms for social support, including the digitalization of the processes of applying for any type of state support, such as subsidies, social benefits, and medical and educational services. For example, in regions with low access to medical services, telemedicine can be an important tool for improving human security. The implementation of telemedicine projects will allow doctors to consult patients remotely, providing primary healthcare and diagnostic services without the need for a physical visit to the hospital. To improve the quality and accessibility of education, the development of distance learning platforms can be encouraged to provide access to education for children and youth from different regions, especially in rural areas or conflict zones. Innovative policies can promote the creation of social enterprises that address human security issues, such as the rehabilitation of war victims, assistance to IDPs, and support for socially vulnerable groups. This can be done through grants, preferential taxation, or social business incubators.
3. Stimulate investment in environmental innovations to improve the environmental situation in regions with a low environmental sub-index. To this end, the development of environmentally friendly technologies, the use of renewable energy sources, and the introduction of innovative methods to reduce pollutant emissions should be encouraged. Innovative policies in this area could include the creation of special environmental funds to support sustainable development projects and attract businesses to green investments. Government incentives, such as reduced income taxes for companies that implement green technologies, can be a powerful incentive. Subsidies for the introduction of green technologies, such as renewable energy sources, can help reduce start-up costs and attract investment. Investing in research and development in environmental technologies can stimulate the creation of new solutions. Government grants for R&D in partnership with universities and businesses can help accelerate the development and commercialization of environmental innovations. The state can stimulate the market for environmental innovations by purchasing environmentally friendly goods and services for its own needs. Incubators and accelerators for environmental start-ups will help young companies develop their innovative products by providing access to funding, mentoring, and market resources. This will create a favorable environment for new businesses aimed at solving environmental problems.
4. Develop a recovery strategy for the regions affected by military operations. Regions that have suffered significant destruction due to military operations require tailored, innovative support. Programs should be established to rebuild infrastructure using modern technologies, such as 3D printing of building structures, as piloted in post-conflict reconstruction efforts in the Netherlands for rapid housing solutions. International partners should be engaged to finance these projects, drawing on models like Rwanda's post-conflict recovery, where mobile banking and digital agricultural platforms revitalized the economy and improved livelihoods (World Bank, 2020). Particular attention should focus on innovations in energy conservation and renewable energy, exemplified by Bosnia and Herzegovina's integration of smart energy grids to restore infrastructure and enhance efficiency (United Nations Development Program [UNDP], 2008). Modernizing industrial enterprises to minimize environmental impact, alongside offering tax incentives for businesses that establish operations in recovering regions, will spur job creation and economic growth. Support for small and medium-sized businesses through soft loans or grants will further stimulate local economies. Promoting agricultural development and restoring essential service businesses are also critical. Engaging communities in reconstruction via local projects will foster social cohesion, while international organizations can provide financial and expert support to implement best practices, ensuring a sustainable recovery.
5. Support the creation of regional innovation clusters that will bring together scientific institutions, business, and government, and contribute to more efficient use of regional potential. Such clusters can focus on the development of specific industries (e.g., IT, agriculture, and biotechnology) to help create new jobs and increase the competitiveness of regions at the national and international levels. The combination of science, business, and government within the cluster creates a favorable environment for innovation. Scientific institutions provide access to research and new

technologies, businesses provide financial resources, and the government creates regulatory and tax incentives. This interaction facilitates the development and introduction of new products and services, increasing the region's productivity and competitiveness. Human capital development is also an important advantage of innovation clusters. Attracting scientists, engineers and young professionals helps create new jobs and training opportunities. Knowledge is shared and professional skills are developed among the local population, which reduces the outflow of personnel and attracts talented professionals from other regions. Innovation clusters are attractive to domestic and foreign investors, as they offer convenient access to innovative solutions, reduce risks, and increase the efficiency of investments. The development of clusters can also attract grants from international organizations, which will help projects develop faster.

Innovative state policies aimed at supporting sustainable development and improving human security can be a key factor in ensuring economic, social, and environmental stability in Ukraine, contributing to balanced regional development and improving the quality of life of the population.

## CONCLUSION

The results of the study of methodological support for a comprehensive assessment of human security in the context of sustainable regional development and proposals for improving innovation policy allow us to draw several important conclusions.

Firstly, a comprehensive assessment of human security in sustainable regional development involves the use of a multi-stage methodology, including the standardization of indicators and the calculation of weighting factors. This approach provides a detailed understanding of the situation in each region of Ukraine in terms of economic, social, and environmental components. The final stage of the methodology, in particular, considers the weight of each indicator, which makes the assessment more accurate and adapted to different regional development conditions.

Secondly, the results of the study show that the economic security of the regions varies significantly. Kyiv is the leader in terms of GDP per capita and labor productivity, which indicates the concentration of resources, capital, and investment in the capital. At the same time, Luhansk Region ranks the lowest, in particular, due to low GDP per capita, labor productivity, and capital investment. Other regions, such as Dnipropetrovsk and Kyiv regions, also demonstrate a relatively high level of economic development due to high investment and significant trade turnover. These regions have a well-developed economic infrastructure, which increases their resilience to economic fluctuations. The correlation analysis showed that the strongest stochastic relationship is between capital investment per enterprise and turnover per enterprise, as well as between labor productivity and GDP per capita. This indicates that a higher level of investment contributes to economic activity and productivity. At the same time, the index of industrial output proved to be less significant for assessing economic security, which may indicate structural problems in the industry in some regions.

Thirdly, social indicators showed significant differences between regions–Kyiv demonstrated a high level of social security due to better access to healthcare services, high-income levels, and access to social infrastructure, but Luhansk region ranked the worst, with the highest unemployment rate and lowest per capita income. Chernivtsi and Ternopil regions also have low average monthly wages, which may indicate insufficient development of social infrastructure. The high correlation between the average monthly salary and per capita disposable income indicates the importance of financial security for the human security of the regions.

Fourthly, the environmental aspect of human security demonstrates insufficient attention to environmental protection measures in many regions. There is a significant disparity in the amount of capital investment in environmental protection per enterprise: Kyiv Region has the highest figures, while in most other regions investments are much lower. This leads to low waste recycling rates and high emissions of harmful substances, especially in Donetsk and Dnipro regions. The strongest correlation exists between environmental expenditures and pollutant emissions, which demonstrates the importance of financing environmental protection measures to reduce environmental risks.

Fifthly, the calculation of the overall human security index shows that Kyiv, Dnipro, and Kyiv regions have the highest scores, which is ensured by high values of economic, social, and environmental indicators. Kyiv is a leader in all three components of the index due to its concentration of resources and developed infrastructure. On the contrary, Luhansk, Chernivtsi, and Kherson regions have the lowest scores, which indicates problems in the economic, social, and environmental security of these regions. The use of index analysis allows us not only to assess the level of security and development of the regions but also to identify the main weaknesses that require additional attention. The poor performance of some regions can serve as a basis for developing special support programs aimed at improving investment attractiveness, reducing unemployment, and enhancing environmental sustainability. This approach will help to achieve more regional development, which is important for the stability of the country as a whole.

Finally, the human security index serves as a vital tool for assessing the sustainable development of regions, integrating not only economic but also social and environmental dimensions. This multidimensional approach provides a comprehensive view of regional development, pinpointing weaknesses and enabling targeted resource allocation to the most vulnerable sectors. As such, it facilitates the creation of effective public policies that enhance living standards and promote sustainable development in Ukraine. To ensure its ongoing relevance, the Index can be adapted or updated periodically–adjusting indicators or weights based on evolving regional conditions, such as post-conflict recovery progress, environmental shifts, or economic trends–allowing policymakers to respond dynamically to emerging challenges and opportunities.

Despite its contributions, the study faces several limitations that warrant consideration. The reliance on regional averages may mask intra-regional disparities, such as urban-rural divides, potentially overestimating security in urban-centric regions like Kyiv while underrepresenting rural challenges. Data constraints, particularly in conflict-affected areas like Luhansk and Donetsk, necessitated the use of pre-conflict averages (2010-2013) for some indicators, which may not fully capture post-2014 realities. Additionally, the selection and weighting of indicators, while methodologically justified, involve subjective decisions that might not fully align with region-specific priorities or emerging threats. Future research could address these limitations by incorporating sub-regional data to reveal internal variations, updating conflict-zone statistics as conditions allow, and engaging local stakeholders to refine indicator selection and weighting through participatory approaches. Further exploration could also test the Index's applicability in other post-conflict or transitional contexts beyond Ukraine or integrate advanced tools like real-time environmental sensors or machine learning to enhance its predictive capacity and responsiveness to dynamic regional needs.

**Author contributions: NB:** Conceptualization, data curation, funding acquisition, methodology, project administration, supervision, and writing – original draft; **VO:** Conceptualization, formal analysis, funding acquisition, methodology, and writing – review & editing; **OY:** Formal analysis, resources, validation, and writing – original draft; **OB:** Conceptualization, investigation, software, and writing – original draft; **PM:** Formal analysis, investigation, resources, validation, and writing – original draft; **OO:** Funding acquisition, resources, software, and writing – original draft; **TK:** Funding acquisition, investigation, validation, visualization, and writing – original draft. All co-authors have agreed with the results and conclusions.

**Funding:** This study was funded by the Ministry of Education and Science of Ukraine and National Academy of Sciences of Ukraine within the framework of research project No. 0123U101614 strategic design of innovative business environment to enhance human security in wartime and postwar conditions, research project No. 0123U100271 organizational and economic support of the post-war sustainable development of territories based on the infrastructure and service methodology of innovation communities' development, and research project No. 0124U000549 digital transformations to ensure civil protection and post-war economic recovery in the face of environmental and social challenges.

**Ethical statement:** The authors stated that this research presents negligible risks concerning privacy, equity, health, and safety. Throughout the study, the authors adhered strictly to the highest ethical benchmarks for scholarly publications, ensuring practices such as informed consent, anonymity, and confidentiality were rigorously upheld. The authors further stated that the authors noted that no institutional ethical clearance was deemed necessary, given that the dataset employed was fully anonymized, no human biological samples were involved, and the investigation did not induce any significant distress among participants.

**Declaration of interest:** No conflict of interest is declared by the authors.

**Data sharing statement:** Data supporting the findings and conclusions are available upon request from the corresponding author.

## REFERENCES

Alaimo, L. S., & Maggino, F. (2020). Sustainable development goals indicators at territorial level: Conceptual and methodological issues–The Italian perspective. *Social Indicators Research*, (147), 383-419. https://doi.org/10.1007/s11205-019-02162-4

Alaimo, L. S., & Seri, E. (2023). Measuring human development by means of composite indicators: Open issues and new methodological tools. *Quality & Quantity, 57*(1), 397-415. https://doi.org/10.1007/s11135-022-01597-1

Anlesinya, A., & Susomrith, P. (2020). Sustainable human resource management: A systematic review of a developing field. *Journal of Global Responsibility, 11*(3), 295-324. https://doi.org/10.1108/JGR-04-2019-0038

Biloshkurska, N. (2010). Adaptive behavior models and their role in formation of enterprise economic security. *Actual Problems of Economics*, (12), 101-105.

Biloshkurska, N., Harnyk, O., Biloshkurskyi, M., Liannoi, M., Kudrina, O., & Omelyanenko, V. (2019). Methodological bases of innovation development priorities integrated assessment. *International Journal of Civil Engineering and Technology, 10*(1), 1231-1240.

Birkmann, J., Jamshed, A., McMillan, J. M., Feldmeyer, D., Totin, E., Solecki, W., & Alegría, A. (2022). Understanding human vulnerability to climate change: A global perspective on index validation for adaptation planning. *Science of The Total Environment*, (803), Article 150065. https://doi.org/10.1016/j.scitotenv.2021.150065

Davymuka, S. A., & Popadynets, N. M. (2024). Trends in the development of innovative entrepreneurship and prospects for post-war reconstruction. *Economic Innovations, 26*(93), 20-32. https://doi.org/10.31520/ei.2024.26.4(93).20-32

Gatto, A. (2020). A pluralistic approach to economic and business sustainability: A critical meta-synthesis of foundations, metrics, and evidence of human and local development. *Corporate Social Responsibility and Environmental Management, 27*(4), 1525-1539. https://doi.org/10.1002/csr.1912

Hickel, J. (2020). The sustainable development index: Measuring the ecological efficiency of human development in the anthropocene. *Ecological Economics*, (167), Article 106331. https://doi.org/10.1016/j.ecolecon.2019.05.011

Keković, Z., Stanković, N., & Galić, D. (2023). The concept of resilience as a broader methodological approach for assessment of human security in local communities. *Security Dialogues, 14*(1), 25-44. https://doi.org/10.47054/SD23141025k

Kharazishvili, Y., Kwilinski, A., Grishnova, O., & Dzwigol, H. (2020). Social safety of society for developing countries to meet sustainable development standards: Indicators, level, strategic benchmarks (with calculations based on the case study of Ukraine). *Sustainability, 12*(21), Article 8953. https://doi.org/10.3390/su12218953

Klopov, I., & Ohrenych, J. (2024). The model of economic recovery of Ukraine in the post-war period: The strategy of the economic miracle. *Baltic Journal of Economic Studies, 10*(5), 184-191. https://doi.org/10.30525/2256-0742/2024-10-5-184-191

Lior, N., Radovanović, M., & Filipović, S. (2018). Comparing sustainable development measurement based on different priorities: Sustainable development goals, economics, and human well-being–Southeast Europe case. *Sustainability Science*, (13), 973-1000. https://doi.org/10.1007/s11625-018-0557-2

Loveridge, R., Sallu, S. M., Pesha, I. J., & Marshall, A. R. (2020). Measuring human wellbeing: A protocol for selecting local indicators. *Environmental Science & Policy*, (114), 461-469. https://doi.org/10.1016/j.envsci.2020.09.002

Maksymenko, I., Akimov, A., & Markova, S. (2024). Trends in the digital transformation of Ukraine's economy in the context of war. *Baltic Journal of Economic Studies, 10*(1), 175-184. https://doi.org/10.30525/2256-0742/2024-10-1-175-184

Martin, M., & Kostovicova, D. (2013). From concept to method: The challenge of a human security methodology. In M. Martin, & T. Owen (Eds.), *Routledge handbook of human security* (pp. 297-307). Routledge. https://doi.org/10.4324/9781315885926

McNeill, D. (2007). 'Human development': The power of the idea. *Journal of Human Development, 8*(1), 5-22. https://doi.org/10.1080/14649880601101366

Nardo, M., Saisana, M., Saltelli, A., Tarantola, S., Hoffman, A., & Giovannini, E. (2005). *Handbook on constructing composite indicators: Methodology and user guide*. OECD Publishing. https://doi.org/10.1787/533411815016

Omelyanenko, V., Martynenko, V., Slatvinskyi, M., Povorozniuk, I., Biloshkurska, N., & Biloshkurskyi, M. (2019). Methodological bases of sectoral innovation priorities evaluation within security-based strategies. *International Journal of Civil Engineering and Technology, 10*(2), 1217-1226.

Omelyanenko, V., Prokopenko, O., Kudrina, O., Petrova, I., Biloshkurska, N., Biloshkurskyi, M., & Omelyanenko, O. (2021). Digital component of innovation landscapes: Con of sustainable development at the local level. In *Proceedings of the 44th International Convention on Information, Communication and Electronic Technology* (pp. 1324-1328). IEEE. https://doi.org/10.23919/mipro52101.2021.9597058

Omelyanenko, V., Semenets-Orlova, I., Khomeriki, O., Lyasota, L., & Medviedieva, Y. (2018). Technology transfer management culture (education-based approach). *Problems and Perspectives in Management, 16*(3), 454-463. https://doi.org/10.21511/ppm.16(3).2018.36

Owen, T. (2008). Measuring human security. In P. H. Liotta, D. A. Mouat, W. G. Kepner, & J. M. Lancaster (Eds.), *Environmental change and human security: Recognizing and acting on hazard impacts* (pp. 31-50). Springer. https://doi.org/10.1007/978-1-4020-8551-2_3

Parish, S. T., Aschner, M., Casey, W., Corvaro, M., Embry, M. R., Fitzpatrick, S., & Boobis, A. (2020). An evaluation framework for new approach methodologies (NAMs) for human health safety assessment. *Regulatory Toxicology and Pharmacology*, (112), Article 104592. https://doi.org/10.1016/j.yrtph.2020.104592

Ponomarenko, T., Prokopenko, O., Slatvinskyi, M., Biloshkurska, N., Biloshkurskyi, M., & Omelyanenko, V. (2019). National investment and innovation security assessment methodology. *International Journal of Mechanical Engineering and Technology, 10*(2), 847-857.

Prokopenko, O., Bezliudnyi, O., Omelyanenko, V., Slatvinskyi, M., Biloshkurska, N., & Biloshkurskyi, M. (2021). Patterns identification in the dynamics of countries' technological development in the context of military conflict. *Eastern-European Journal of Enterprise Technologies, 2*(110), 6-15. https://doi.org/10.15587/1729-4061.2021.230236

Prokopenko, O., Slatvinskyi, M., Biloshkurska, N., Biloshkurskyi, M., & Omelyanenko, V. (2019). Methodology of national investment and innovation security analytics. *Problems and Perspectives in Management, 17*(1), 380-394. https://doi.org/10.21511/ppm.17(1).2019.33

Rahma, H., Fauzi, A., Juanda, B., & Widjojanto, B. (2019). Development of a composite measure of regional sustainable development in Indonesia. *Sustainability, 11*(20), Article 5861. https://doi.org/10.3390/su11205861

Roy, S., Bose, A., Basak, D., & Chowdhury, I. R. (2024). Towards sustainable society: The sustainable livelihood security (SLS) approach for prioritizing development and understanding sustainability: An insight from West Bengal, India. *Environmental Development and Sustainability*, (26), 20095-20126. https://doi.org/10.1007/s10668-023-03456-x

Serohin, V., Serohina, S., Bodrova, I., Hrytsenko, H., & Omelianenko, O. (2023). The potential of territorial communities as a factor of socio-environmental development of territories. *WSEAS Transactions on Environment and Development*, (19), 197-206. https://doi.org/10.37394/232015.2023.19.17

State Statistics Service of Ukraine. (2024). Statistical information. *State Statistics Service of Ukraine*. https://www.ukrstat.gov.ua

UNDP. (2008). Crisis prevention and recovery report 2008: Post-conflict economic recovery–Enabling local ingenuity. *United Nations Development Program*. https://www.undp.org/publications/crisis-prevention-and-recovery-report-2008-post-conflict-economic-recovery-enabling-local-ingenuity

Wali, N. S., & Al-Najjar, S. A. (2020). Conceptual evolution and fundamental challenges in transition from Cold War security discourse and emergence of human security discourse in the age of globalization. *UKH Journal of Social Sciences, 4*(1), 58-68. https://doi.org/10.25079/ukhjss.v4n1y2020.pp58-68

World Bank. (2020). *Future drivers of growth in Rwanda: Innovation, integration, agglomeration, and competition. Rwanda economic update, no. 14*. World Bank. https://doi.org/10.1596/978-1-4648-1280-4

# APPENDIX A

**Table A1.** Gross regional product per capita* by region for 2010-2020 (UAH)

| Region | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cherkasy | 17,325 | 21,082 | 24,558 | 26,168 | 30,628 | 40,759 | 48,025 | 59,612 | 76,881 | 86,279 | 91,817 | 47,558 |
| Chernihiv | 15,406 | 19,357 | 22,096 | 22,603 | 26,530 | 35,196 | 41,726 | 55,139 | 69,712 | 78,098 | 85,435 | 42,845 |
| Chernivtsi | 10,939 | 13,228 | 14,529 | 15,154 | 16,552 | 20,338 | 23,365 | 31,495 | 37,443 | 46,135 | 50,110 | 25,390 |
| City of Kyiv | 70,424 | 79,729 | 97,429 | 109,402 | 124,163 | 155,904 | 191,736 | 238,687 | 283,175 | 320,898 | 342,247 | 183,072 |
| Dnipropetrovsk | 34,709 | 42,068 | 44,650 | 46,333 | 53,749 | 65,897 | 75,396 | 97,043 | 114,750 | 122,298 | 126,209 | 74,827 |
| Donetsk | 28,986 | 36,446 | 38,907 | 37,830 | 27,771 | 26,864 | 32,318 | 39,299 | 45,936 | 49,385 | 50,124 | 37,624 |
| Ivano-Frankivsk | 14,814 | 19,386 | 23,379 | 24,022 | 27,232 | 33,170 | 37,220 | 46,282 | 57,030 | 63,237 | 66,245 | 37,456 |
| Kharkiv | 23,639 | 27,966 | 29,972 | 31,128 | 35,328 | 45,816 | 57,150 | 69,409 | 86,889 | 92,835 | 97,428 | 54,324 |
| Kherson | 14,346 | 16,990 | 17,910 | 19,311 | 21,725 | 30,246 | 36,585 | 45,486 | 52,914 | 59,972 | 66,973 | 34,769 |
| Khmelnytskyi | 13,602 | 17,260 | 19,920 | 20,165 | 24,662 | 31,660 | 37,881 | 49,858 | 59,576 | 65,893 | 77,153 | 37,966 |
| Kirovohrad | 15,533 | 19,918 | 22,082 | 25,533 | 29,223 | 39,356 | 47,469 | 55,128 | 67,743 | 77,788 | 81,166 | 43,722 |
| Kyiv | 26,140 | 34,420 | 40,483 | 39,988 | 46,058 | 60,109 | 74,216 | 89,904 | 112,510 | 123,216 | 135,817 | 71,169 |
| Luhansk | 19,788 | 25,067 | 25,950 | 24,514 | 14,079 | 10,778 | 14,251 | 13,873 | 16,300 | 18,793 | 20,297 | 18,517 |
| Lviv | 16,353 | 20,490 | 24,387 | 24,937 | 28,731 | 37,338 | 45,319 | 58,183 | 70,169 | 85,177 | 94,317 | 45,946 |
| Mykolaiv | 20,276 | 23,402 | 24,838 | 27,355 | 30,357 | 41,501 | 50,091 | 60,486 | 70,325 | 82,121 | 86,750 | 47,046 |
| Odesa | 22,544 | 25,748 | 27,070 | 29,118 | 31,268 | 41,682 | 50,159 | 62,643 | 72,731 | 82,879 | 92,823 | 48,970 |
| Poltava | 29,652 | 35,246 | 38,424 | 39,962 | 48,040 | 66,390 | 81,145 | 105,994 | 123,722 | 134,383 | 136,608 | 76,324 |
| Rivne | 13,785 | 16,735 | 18,860 | 19,003 | 24,762 | 30,350 | 33,958 | 42,004 | 49,038 | 58,318 | 62,485 | 33,573 |
| Sumy | 15,711 | 19,800 | 21,722 | 23,517 | 26,943 | 37170 | 41,741 | 51,367 | 62,943 | 70,550 | 75,815 | 40,662 |
| Ternopil | 11,713 | 15,055 | 16,644 | 16,819 | 20,228 | 24,963 | 29,247 | 38,563 | 46,828 | 54,821 | 60,565 | 30,495 |
| Vinnytsia | 14,332 | 17,768 | 20,253 | 22,303 | 27,249 | 37,270 | 46,615 | 58,296 | 71,098 | 83,133 | 88,380 | 44,245 |
| Volyn | 13,916 | 16,993 | 19,249 | 19,817 | 23,218 | 30,387 | 34,310 | 49,937 | 58,294 | 73,192 | 75,193 | 37,682 |
| Zakarpattia | 12,278 | 14,455 | 17,088 | 17,044 | 19,170 | 22,989 | 25,727 | 34,197 | 41,706 | 48,853 | 49,538 | 27,550 |
| Zaporizhzhia | 23,657 | 27,567 | 30,656 | 30,526 | 37,251 | 50,609 | 59,729 | 75,196 | 85,764 | 91,452 | 99,738 | 55,650 |
| Zhytomyr | 14,616 | 17,184 | 19,551 | 20,286 | 23,678 | 30,698 | 38,520 | 49,700 | 62,905 | 70,225 | 76,017 | 38,489 |

Note. *This indicator is an incentive (compiled and calculated according to the State Statistics Service of Ukraine, 2024)

**Table A2.** Indices of industrial production* by region for 2010-2020 (%)

| Region | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cherkasy | 117.1 | 103.4 | 94.9 | 95.2 | 94.7 | 90.8 | 106.3 | 99.1 | 102.3 | 101.3 | 96.8 | 99.9 |
| Chernihiv | 99.8 | 98.0 | 98.1 | 89.6 | 97.2 | 91.2 | 105.8 | 96.5 | 99.2 | 89.9 | 93.2 | 96.1 |
| Chernivtsi | 111.9 | 89.6 | 86.8 | 103.7 | 92.9 | 98.3 | 96.9 | 106.7 | 105.8 | 100.3 | 85.9 | 97.7 |
| City of Kyiv | 104.1 | 102.0 | 95.9 | 89.9 | 85.9 | 94.6 | 104.4 | 95.8 | 98.1 | 98.0 | 97.7 | 96.8 |
| Dnipropetrovsk | 116.1 | 105.4 | 102.2 | 98.5 | 92.5 | 92.1 | 99.3 | 100.1 | 103.0 | 101.0 | 87.8 | 99.6 |
| Donetsk | 114.7 | 113.6 | 94.6 | 93.6 | 68.5 | 65.4 | 106.4 | 89.1 | 102.6 | 100.6 | 96.6 | 93.7 |
| Ivano-Frankivsk | 100.2 | 125.7 | 101.2 | 95.3 | 98.9 | 89.1 | 95.5 | 112.0 | 110.3 | 95.6 | 93.4 | 101.1 |
| Kharkiv | 105.8 | 105.5 | 97.6 | 94.5 | 94.8 | 88.2 | 105.8 | 106.1 | 102.9 | 96.7 | 95.8 | 99.3 |
| Kherson | 100.5 | 93.1 | 104.7 | 92.4 | 96.4 | 98.1 | 102.0 | 103.2 | 101.1 | 104.4 | 104.8 | 100.0 |
| Khmelnytskyi | 104.9 | 109.2 | 101.2 | 97.6 | 97.8 | 95.7 | 104.7 | 101.6 | 95.3 | 85.5 | 98.0 | 99.0 |
| Kirovohrad | 113.3 | 111.0 | 107.5 | 106.6 | 100.8 | 82.9 | 120.3 | 105.5 | 102.2 | 103.6 | 102.2 | 104.7 |
| Kyiv | 108.0 | 110.6 | 96.8 | 99.1 | 101.6 | 93.0 | 106.2 | 110.3 | 102.0 | 99.7 | 98.5 | 102.2 |
| Luhansk | 107.1 | 115.8 | 92.5 | 91.1 | 58.0 | 34.0 | 139.0 | 69.0 | 83.0 | 96.0 | 93.4 | 84.0 |
| Lviv | 100.9 | 112.8 | 101.6 | 101.2 | 97.2 | 98.5 | 99.3 | 106.0 | 102.4 | 97.0 | 105.4 | 101.9 |
| Mykolaiv | 110.3 | 104.2 | 99.5 | 96.5 | 101.4 | 91.1 | 110.5 | 101.5 | 104.0 | 98.3 | 102.6 | 101.7 |
| Odesa | 102.9 | 83.6 | 96.9 | 100.6 | 99.7 | 96.1 | 109.2 | 112.2 | 92.4 | 107.4 | 100.7 | 99.9 |
| Poltava | 112.6 | 99.6 | 100.0 | 94.7 | 92.9 | 96.2 | 100.1 | 98.9 | 101.5 | 98.8 | 99.8 | 99.4 |
| Rivne | 129.6 | 107.6 | 96.7 | 91.4 | 103.7 | 100.3 | 98.1 | 109.3 | 95.6 | 106.9 | 97.3 | 102.9 |
| Sumy | 93.5 | 107.7 | 95.6 | 107.0 | 88.1 | 98.4 | 91.2 | 101.7 | 110.3 | 98.3 | 95.5 | 98.6 |
| Ternopil | 102.5 | 112.4 | 102.1 | 99.5 | 116.5 | 92.1 | 110.3 | 108.5 | 98.2 | 98.3 | 91.7 | 102.6 |
| Vinnytsia | 106.5 | 100.0 | 107.1 | 110.4 | 105.4 | 104.0 | 105.3 | 108.2 | 99.2 | 114.7 | 94.5 | 104.9 |
| Volyn | 126.7 | 112.6 | 94.5 | 102.9 | 103.2 | 98.6 | 100.2 | 105.7 | 102.2 | 94.9 | 95.7 | 103.0 |
| Zakarpattia | 142.9 | 101.8 | 101.4 | 96.9 | 106.1 | 79.7 | 105.9 | 100.3 | 105.1 | 86.1 | 92.7 | 100.7 |
| Zaporizhzhia | 107.8 | 106.3 | 96.8 | 97.1 | 96.8 | 95.3 | 96.9 | 106.2 | 103.6 | 95.5 | 92.9 | 99.4 |
| Zhytomyr | 108.2 | 125.3 | 116.6 | 113.4 | 107.1 | 110.0 | 105.7 | 109.5 | 97.5 | 94.3 | 97.6 | 107.4 |

Note. *This indicator is an incentive (compiled and calculated according to the State Statistics Service of Ukraine, 2024)

**Table A3.** Capital investments per enterprise* by region for 2010-2020 (UAH thousand)

| Region | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cherkasy | 388.0 | 452.1 | 526.2 | 430.4 | 400.1 | 540.7 | 807.3 | 918.8 | 1,210.8 | 1,172.7 | 977.7 | 738.0 |
| Chernihiv | 364.8 | 434.1 | 465.0 | 456.9 | 435.6 | 589.9 | 1,015.8 | 1,245.1 | 1,469.5 | 1,356.6 | 1,272.3 | 839.3 |
| Chernivtsi | 322.7 | 480.9 | 558.2 | 542.6 | 415.0 | 688.0 | 762.5 | 762.3 | 908.3 | 967.4 | 789.4 | 646.4 |
| City of Kyiv | 622.4 | 769.4 | 1,056.8 | 809.7 | 776.1 | 1,008.7 | 1,394.5 | 1,597.5 | 2,188.9 | 2,093.5 | 1,610.2 | 1,286.0 |
| Dnipropetrovsk | 584.9 | 823.2 | 822.6 | 755.1 | 776.1 | 951.2 | 1,296.5 | 1,538.4 | 2,070.4 | 2,146.5 | 1,901.0 | 1,267.1 |
| Donetsk | 547.5 | 927.7 | 1,132.6 | 971.5 | 1,157.4 | 706.0 | 1,135.4 | 1,652.5 | 2,772.5 | 2,970.6 | 2,807.7 | 1,266.1 |
| Ivano-Frankivsk | 571.8 | 556.9 | 673.2 | 599.9 | 860.6 | 1,209.9 | 1,154.7 | 1,270.8 | 1,131.5 | 1,082.7 | 780.2 | 899.7 |
| Kharkiv | 312.6 | 506.4 | 591.3 | 356.2 | 323.6 | 451.0 | 809.7 | 856.8 | 989.8 | 913.1 | 805.3 | 620.0 |
| Kherson | 263.4 | 399.5 | 318.8 | 262.2 | 270.6 | 388.0 | 640.3 | 908.1 | 1077.3 | 1453.2 | 887.0 | 638.0 |
| Khmelnytskyi | 454.2 | 553.5 | 529.6 | 525.3 | 585.3 | 973.9 | 1,464.9 | 1,509.9 | 1,517.3 | 1,339.5 | 1,387.1 | 1,000.7 |
| Kirovohrad | 313.0 | 601.2 | 652.7 | 436.8 | 408.4 | 528.0 | 882.1 | 946.5 | 890.1 | 890.3 | 788.7 | 676.9 |
| Kyiv | 742.8 | 1,071.0 | 1,165.0 | 1,108.2 | 1,099.6 | 1,341.1 | 1,873.9 | 1,783.7 | 2,030.2 | 2,386.3 | 1,612.2 | 1,509.4 |
| Luhansk | 516.7 | 631.2 | 766.2 | 998.6 | 1,615.4 | 614.2 | 1,169.1 | 977.1 | 933.4 | 899.7 | 956.3 | 832.5 |
| Lviv | 434.1 | 726.5 | 644.7 | 523.2 | 514.2 | 718.6 | 1,193.7 | 1,344.2 | 1,507.6 | 1,516.7 | 1,130.6 | 935.5 |
| Mykolaiv | 393.9 | 506.5 | 460.5 | 465.2 | 360.9 | 566.7 | 968.1 | 1,034.9 | 883.3 | 1,022.1 | 827.8 | 690.1 |
| Odesa | 389.4 | 396.9 | 592.9 | 456.3 | 391.0 | 418.0 | 796.5 | 928.3 | 962.9 | 814.8 | 841.8 | 635.0 |
| Poltava | 657.5 | 816.1 | 1,045.6 | 941.5 | 883.0 | 822.1 | 1,698.2 | 1,556.3 | 1,700.7 | 2,011.1 | 2,265.6 | 1,331.3 |
| Rivne | 380.0 | 523.7 | 562.6 | 548.4 | 540.5 | 825.1 | 920.6 | 1,160.4 | 1,303.5 | 1,129.8 | 938.5 | 815.1 |
| Sumy | 406.6 | 557.2 | 528.6 | 467.8 | 480.9 | 627.0 | 1,090.0 | 1,217.7 | 1,302.7 | 1,243.0 | 1,181.1 | 836.2 |
| Ternopil | 452.2 | 507.9 | 701.6 | 568.6 | 502.0 | 751.1 | 1,150.4 | 1,518.2 | 1,660.7 | 1,808.8 | 1,421.0 | 1,002.3 |
| Vinnytsia | 444.1 | 629.2 | 666.1 | 655.5 | 608.1 | 780.9 | 960.3 | 1,278.3 | 1,814.7 | 1,527.4 | 1,379.2 | 1,000.1 |
| Volyn | 339.7 | 526.4 | 628.6 | 603.7 | 614.5 | 1,101.2 | 1,266.5 | 1,258.2 | 1,468.1 | 2,012.7 | 1,508.5 | 1,059.0 |
| Zakarpattia | 380.7 | 547.5 | 486.2 | 439.2 | 434.6 | 618.3 | 921.9 | 971.6 | 1,167.6 | 1,460.6 | 763.5 | 751.8 |
| Zaporizhzhia | 545.9 | 447.0 | 503.8 | 462.8 | 485.7 | 540.4 | 819.3 | 1,089.4 | 1,049.3 | 950.5 | 1,008.3 | 721.3 |
| Zhytomyr | 317.8 | 405.2 | 465.0 | 452.3 | 441.0 | 612.1 | 939.9 | 1,189.6 | 1,264.6 | 1,158.9 | 1,313.1 | 790.4 |

Note. *This indicator is an incentive (compiled and calculated according to the State Statistics Service of Ukraine, 2024)

**Table A4.** Turnover per enterprise* by region for 2010-2020 (UAH thousand)

| Region | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cherkasy | 6,260.2 | 7,725.8 | 8,867.8 | 7,612.4 | 9,054.7 | 12,643.9 | 14,638.0 | 16,182.8 | 18,885.0 | 21,297.7 | 23,160.7 | 13,833.9 |
| Chernihiv | 4,255.7 | 4,892.8 | 5,655.5 | 5,367.8 | 6,763.7 | 10,050.4 | 14,605.2 | 16,248.8 | 16,671.3 | 16,558.9 | 18,316.2 | 10,995.1 |
| Chernivtsi | 1,942.7 | 3,381.0 | 3,327.6 | 3,017.9 | 3,536.4 | 4,463.6 | 5,910.3 | 6,895.1 | 7,620.0 | 8,160.6 | 9,393.2 | 5,174.1 |
| City of Kyiv | 13,484.0 | 14,035.4 | 18,297.7 | 15,573.9 | 17,802.5 | 22,099.7 | 32,794.7 | 36,917.2 | 42,143.0 | 39,511.8 | 41,147.6 | 27,137.5 |
| Dnipropetrovsk | 13,957.7 | 17,145.3 | 16,361.7 | 15,767.5 | 18,169.0 | 21,433.2 | 26,273.7 | 32,101.1 | 36,070.9 | 34,909.7 | 35,693.2 | 24,692.5 |
| Donetsk | 18,229.8 | 23,741.2 | 23,728.7 | 20,037.6 | 33,092.7 | 27,671.1 | 32,582.2 | 38,028.1 | 47,004.4 | 41,860.5 | 39,772.8 | 27,501.8 |
| Ivano-Frankivsk | 3,983.2 | 4,530.7 | 4,997.3 | 5,188.1 | 5,344.4 | 6,781.8 | 9,814.5 | 10,408.8 | 11,770.3 | 14,013.8 | 15,581.1 | 8,484.8 |
| Kharkiv | 5,713.6 | 6,531.4 | 7,181.9 | 6,225.4 | 7,065.6 | 9,640.2 | 13,365.1 | 14,614.7 | 15,852.5 | 15,702.8 | 17,470.6 | 10,714.9 |
| Kherson | 3,723.9 | 4,123.5 | 3,518.6 | 3,330.9 | 3,929.4 | 5,685.6 | 7,742.6 | 8,070.1 | 8,922.9 | 8,802.4 | 10,142.9 | 6,253.7 |
| Khmelnytskyi | 3,447.2 | 4,469.8 | 4,994.8 | 5,041.1 | 6,077.6 | 8,237.9 | 10,696.6 | 12,872.4 | 14,205.4 | 13,986.7 | 16,469.1 | 9,366.1 |
| Kirovohrad | 3,853.1 | 4,965.1 | 6,319.8 | 6,219.1 | 7,389.5 | 8,599.7 | 10,237.9 | 10,865.4 | 12,288.3 | 12,561.9 | 14,227.2 | 9,112.2 |
| Kyiv | 9,467.5 | 11,138.0 | 13,026.1 | 12,389.9 | 14,474.5 | 18,137.2 | 21,783.0 | 21,303.0 | 24,445.5 | 24,777.4 | 28,495.2 | 18,597.5 |
| Luhansk | 9,593.8 | 11,520.7 | 10,930.9 | 9,155.6 | 14,165.3 | 10,311.3 | 13,707.6 | 11,427.3 | 11,569.5 | 11,251.4 | 13,437.5 | 10,982.3 |
| Lviv | 4,819.7 | 7,336.7 | 7,615.1 | 6,986.5 | 8,056.6 | 9,829.4 | 13,138.6 | 14,627.0 | 18,237.5 | 19,851.0 | 21,074.1 | 12,135.8 |
| Mykolaiv | 4,169.3 | 5,800.2 | 5,177.0 | 5,027.4 | 6,104.3 | 9,161.8 | 11,944.9 | 12,328.7 | 13,197.0 | 13,381.9 | 14,741.1 | 9,353.1 |
| Odesa | 5,308.9 | 5,818.8 | 5,716.5 | 5,241.2 | 6,547.9 | 8,873.2 | 13,271.1 | 13,614.7 | 15,298.3 | 15,102.0 | 17,679.4 | 10,221.2 |
| Poltava | 10,630.5 | 11,377.2 | 12,177.4 | 10,979.4 | 13,194.8 | 17,986.0 | 23,421.5 | 25,452.6 | 26,846.6 | 25,922.7 | 27,453.6 | 18,953.8 |
| Rivne | 3,983.1 | 5,130.8 | 5,183.9 | 5,504.7 | 7,267.0 | 8,123.2 | 10,493.4 | 11,420.2 | 12,238.4 | 12,224.3 | 13,567.8 | 8,818.2 |
| Sumy | 4,690.1 | 6,093.4 | 6,767.6 | 5,938.5 | 6,897.2 | 10,334.8 | 13,277.2 | 15,190.8 | 17,586.9 | 17,246.3 | 19,457.8 | 11,393.9 |
| Ternopil | 3,651.4 | 6,769.5 | 10,165.8 | 9,558.3 | 11,820.5 | 14,736.9 | 10,897.9 | 12,697.0 | 14,120.7 | 13,977.3 | 16,485.6 | 11,416.1 |
| Vinnytsia | 4,550.7 | 5,188.7 | 5,282.3 | 5,006.8 | 7,153.6 | 10,601.9 | 13,795.9 | 15,797.6 | 17,635.7 | 18,943.2 | 20,413.4 | 11,630.2 |
| Volyn | 7,288.0 | 7,701.4 | 10,109.1 | 10,216.9 | 11,135.4 | 14,950.8 | 20,774.2 | 27,081.0 | 29,220.6 | 29,812.9 | 29,520.2 | 18,499.4 |
| Zakarpattia | 3,493.4 | 4,731.5 | 4,893.1 | 4,984.4 | 5,747.1 | 6,594.6 | 8,025.9 | 8,604.8 | 9,301.8 | 9,774.1 | 9,673.5 | 6,965.5 |
| Zaporizhzhia | 7,327.5 | 8,323.1 | 8,690.2 | 7,683.5 | 9,534.9 | 12,737.1 | 16,147.5 | 19,292.1 | 21,511.0 | 19,555.9 | 19,733.7 | 13,749.1 |
| Zhytomyr | 3,605.6 | 4,377.0 | 4,851.9 | 4,764.7 | 5,721.8 | 7,143.6 | 12,410.6 | 13,676.4 | 15,705.5 | 15,527.8 | 16,888.8 | 9,686.4 |

Note. *This indicator is an incentive (compiled and calculated according to the State Statistics Service of Ukraine, 2024)

**Table A5.** Labor productivity per employee* by region for 2010-2020 (UAH thousand)

| Region | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cherkasy | 292.1 | 355.3 | 429.8 | 425.6 | 547.0 | 824.3 | 933.0 | 1,132.5 | 1,317.0 | 1,447.1 | 1,505.9 | 821.3 |
| Chernihiv | 178.8 | 222.4 | 290.8 | 311.3 | 403.6 | 630.5 | 792.9 | 985.5 | 987.9 | 918.1 | 1,021.8 | 599.4 |
| Chernivtsi | 159.2 | 201.5 | 225.3 | 230.3 | 281.1 | 383.3 | 437.0 | 566.0 | 613.2 | 610.9 | 665.7 | 389.6 |
| City of Kyiv | 736.4 | 829.7 | 911.2 | 897.9 | 1,035.9 | 1,402.4 | 1,566.6 | 1,932.3 | 2,325.5 | 2,309.5 | 2,372.9 | 1,513.6 |
| Dnipropetrovsk | 511.0 | 623.7 | 591.2 | 607.1 | 700.4 | 918.5 | 1,145.7 | 1,488.2 | 1,714.6 | 1,687.9 | 1,667.3 | 1,027.6 |
| Donetsk | 544.8 | 761.6 | 742.7 | 677.8 | 814.1 | 797.6 | 1,096.1 | 1,514.4 | 1,779.7 | 1,579.5 | 1,415.5 | 884.5 |
| Ivano-Frankivsk | 309.2 | 352.1 | 400.3 | 457.8 | 476.6 | 654.1 | 757.0 | 891.3 | 1,040.1 | 1,140.9 | 1,143.2 | 702.5 |
| Kharkiv | 318.0 | 372.3 | 397.0 | 374.1 | 429.0 | 616.0 | 804.0 | 948.4 | 1,031.8 | 998.7 | 1,123.3 | 650.3 |
| Kherson | 250.9 | 266.0 | 270.6 | 295.3 | 382.9 | 578.7 | 706.4 | 816.2 | 901.4 | 875.8 | 915.0 | 548.6 |
| Khmelnytskyi | 180.5 | 236.1 | 281.5 | 308.5 | 387.5 | 551.6 | 645.3 | 853.6 | 958.0 | 894.0 | 1,013.0 | 571.0 |
| Kirovohrad | 251.7 | 306.6 | 423.6 | 461.0 | 595.2 | 729.3 | 825.2 | 924.6 | 1,072.1 | 1,036.7 | 1,125.1 | 698.9 |
| Kyiv | 436.0 | 547.4 | 620.8 | 638.2 | 737.6 | 1,000.5 | 1,183.5 | 1,376.0 | 1,568.1 | 1,630.9 | 1,774.0 | 1,028.4 |
| Luhansk | 280.8 | 345.4 | 331.0 | 313.2 | 354.3 | 311.6 | 467.8 | 403.6 | 624.8 | 644.6 | 618.7 | 361.5 |
| Lviv | 246.0 | 317.4 | 354.4 | 374.4 | 442.0 | 563.5 | 736.2 | 900.8 | 1,085.1 | 1,145.6 | 1,260.1 | 658.6 |
| Mykolaiv | 317.3 | 349.1 | 385.7 | 416.1 | 525.0 | 846.8 | 1,044.3 | 1,150.9 | 1,302.1 | 1,284.2 | 1,324.2 | 790.2 |
| Odesa | 349.1 | 369.3 | 390.3 | 396.8 | 490.6 | 701.4 | 1,062.7 | 1,227.4 | 1,368.9 | 1,368.4 | 1,511.5 | 790.7 |
| Poltava | 434.2 | 465.6 | 500.4 | 483.3 | 591.3 | 872.8 | 970.9 | 1,195.8 | 1,299.0 | 1,378.1 | 1,474.3 | 865.2 |
| Rivne | 195.7 | 254.7 | 268.9 | 314.2 | 444.1 | 516.5 | 599.7 | 734.6 | 747.4 | 716.8 | 800.6 | 504.6 |
| Sumy | 182.5 | 243.7 | 280.7 | 279.5 | 345.6 | 547.9 | 641.5 | 784.0 | 956.4 | 877.7 | 978.6 | 540.4 |
| Ternopil | 197.1 | 392.9 | 584.6 | 619.8 | 775.8 | 1,037.4 | 666.2 | 844.0 | 898.7 | 801.7 | 926.0 | 696.8 |
| Vinnytsia | 215.3 | 253.1 | 284.5 | 303.5 | 445.2 | 692.7 | 838.9 | 1036.8 | 1,102.4 | 1,128.1 | 1,181.3 | 678.0 |
| Volyn | 326.8 | 332.3 | 467.1 | 529.8 | 628.9 | 861.9 | 1,073.0 | 1,516.6 | 1,602.3 | 1,607.3 | 1,582.0 | 955.1 |
| Zakarpattia | 202.4 | 275.1 | 310.2 | 358.2 | 439.3 | 529.3 | 519.3 | 637.1 | 749.4 | 701.4 | 725.1 | 486.6 |
| Zaporizhzhia | 331.5 | 391.2 | 404.1 | 394.6 | 506.5 | 713.0 | 856.2 | 1,103.5 | 1,282.8 | 1,167.7 | 1,145.6 | 727.6 |
| Zhytomyr | 162.6 | 205.7 | 240.1 | 264.8 | 332.2 | 432.3 | 652.9 | 766.5 | 892.9 | 879.1 | 890.8 | 517.4 |

Note. *This indicator is an incentive (compiled and calculated according to the State Statistics Service of Ukraine, 2024)

# APPENDIX B

**Table B1.** Average monthly wages of regular employees* by region for 2010-2020 (UAH)

| Region | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cherkasy | 1,835 | 2,155 | 2,508 | 2,682 | 2,829 | 3,360 | 4,148 | 6,042 | 7,478 | 8,838 | 9,797 | 4,697 |
| Chernihiv | 1,711 | 1,974 | 2,308 | 2,504 | 2,690 | 3,295 | 4,002 | 5,636 | 6,995 | 8,206 | 9,328 | 4,423 |
| Chernivtsi | 1,772 | 1,985 | 2,329 | 2,484 | 2,578 | 3,050 | 3,828 | 5,621 | 6,991 | 8,066 | 9,166 | 4,352 |
| City of Kyiv | 3,431 | 4,012 | 4,607 | 5,007 | 5,376 | 6,732 | 8,648 | 11,135 | 13,542 | 15,776 | 17,086 | 8,668 |
| Dnipropetrovsk | 2,369 | 2,790 | 3,138 | 3,336 | 3,641 | 4,366 | 5,075 | 6,939 | 8,862 | 10,751 | 11,681 | 5,722 |
| Donetsk | 2,549 | 3,063 | 3,496 | 3,755 | 3,858 | 4,980 | 5,989 | 7,764 | 9,686 | 11,716 | 12,647 | 6,318 |
| Ivano-Frankivsk | 1,927 | 2,213 | 2,539 | 2,679 | 2,875 | 3,402 | 4,202 | 6,074 | 7,551 | 8,817 | 9,980 | 4,751 |
| Kharkiv | 2,060 | 2,407 | 2,753 | 2,975 | 3,143 | 3,697 | 4,448 | 6,244 | 7,657 | 9,081 | 9,968 | 4,948 |
| Kherson | 1,733 | 1,970 | 2,269 | 2,464 | 2,617 | 3,123 | 4,046 | 5,842 | 7,058 | 8,187 | 9,354 | 4,424 |
| Khmelnytskyi | 1,786 | 2,075 | 2,425 | 2,641 | 2,878 | 3,371 | 4,043 | 5,938 | 7,346 | 8,672 | 9,872 | 4,641 |
| Kirovohrad | 1,815 | 2,114 | 2,428 | 2,608 | 2,789 | 3,282 | 3,974 | 5,792 | 7,191 | 8,360 | 9,603 | 4,542 |
| Kyiv | 2,295 | 2,761 | 3,157 | 3,351 | 3,489 | 4,153 | 5,229 | 7,188 | 9,097 | 11,003 | 11,887 | 5,783 |
| Luhansk | 2,271 | 2,742 | 3,090 | 3,337 | 3,377 | 3,427 | 4,637 | 5,862 | 7,365 | 8,731 | 10,182 | 5,002 |
| Lviv | 1,941 | 2,244 | 2,578 | 2,789 | 2,961 | 3,646 | 4,559 | 6,391 | 8,001 | 9,271 | 10,299 | 4,971 |
| Mykolaiv | 2,122 | 2,448 | 2,822 | 3,094 | 3,344 | 3,984 | 4,887 | 6,709 | 8,160 | 9,976 | 11,414 | 5,360 |
| Odesa | 2,046 | 2,387 | 2,700 | 2,947 | 3,129 | 3,897 | 4,809 | 6,542 | 8,011 | 9,246 | 10,336 | 5,095 |
| Poltava | 2,102 | 2,481 | 2,850 | 2,988 | 3,179 | 3,783 | 4,621 | 6,551 | 8,375 | 9,846 | 10,819 | 5,236 |
| Rivne | 1,960 | 2,211 | 2,575 | 2,844 | 3,033 | 3,573 | 4,364 | 6,013 | 7,469 | 8,967 | 10,254 | 4,842 |
| Sumy | 1,866 | 2,177 | 2,503 | 2,702 | 2,877 | 3,449 | 4,131 | 5,946 | 7,324 | 8,579 | 9,785 | 4,667 |
| Ternopil | 1,659 | 1,871 | 2,185 | 2,359 | 2,527 | 2,994 | 3,695 | 5,554 | 6,969 | 8,275 | 9,384 | 4,316 |
| Vinnytsia | 1,782 | 2,074 | 2,432 | 2,651 | 2,810 | 3,396 | 4,189 | 6,121 | 7,801 | 9,299 | 10,297 | 4,805 |
| Volyn | 1,692 | 1,994 | 2,339 | 2,580 | 2,721 | 3,291 | 4,047 | 5,849 | 7,324 | 8,663 | 9,256 | 4,523 |
| Zakarpattia | 1,846 | 2,069 | 2,351 | 2,553 | 2,744 | 3,381 | 4,298 | 6,355 | 8,070 | 9,202 | 10,193 | 4,824 |
| Zaporizhzhia | 2,187 | 2,607 | 2,927 | 3,142 | 3,432 | 4,200 | 5,080 | 6,863 | 8,726 | 10,480 | 11,556 | 5,564 |
| Zhytomyr | 1,785 | 2,071 | 2,369 | 2,561 | 2,763 | 3,271 | 4,000 | 5,836 | 7,372 | 8,528 | 9,571 | 4,557 |

Note. *This indicator is an incentive (compiled and calculated according to the State Statistics Service of Ukraine, 2024)

**Table B2.** ILO unemployment rate of population* by region for 2010-2020 (%)

| Region | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cherkasy | 10.8 | 10.0 | 9.7 | 9.5 | 10.5 | 10.0 | 10.5 | 10.2 | 9.8 | 8.3 | 9.5 | 9.9 |
| Chernihiv | 12.0 | 11.9 | 11.0 | 10.3 | 12.1 | 11.2 | 11.8 | 11.2 | 11.0 | 10.1 | 11.8 | 11.3 |
| Chernivtsi | 10.1 | 9.6 | 9.3 | 8.6 | 10.2 | 10.5 | 9.7 | 8.4 | 8.9 | 6.7 | 8.7 | 9.2 |
| City of Kyiv | 6.4 | 6.1 | 6.0 | 5.7 | 7.2 | 7.5 | 7.1 | 6.9 | 6.6 | 5.7 | 6.7 | 6.5 |
| Dnipropetrovsk | 7.6 | 7.3 | 7.0 | 6.8 | 8.3 | 7.4 | 8.1 | 8.5 | 8.2 | 7.7 | 8.6 | 7.8 |
| Donetsk | 9.1 | 8.7 | 8.5 | 8.2 | 11.3 | 14.2 | 14.6 | 14.6 | 14.4 | 13.5 | 14.8 | 12.0 |
| Ivano-Frankivsk | 8.9 | 9.3 | 8.4 | 7.8 | 8.6 | 8.9 | 9.2 | 8.5 | 8.3 | 7.1 | 8.3 | 8.5 |
| Kharkiv | 7.7 | 7.6 | 7.2 | 6.8 | 8.1 | 7.3 | 6.6 | 6.1 | 5.5 | 5.0 | 6.2 | 6.7 |
| Kherson | 9.4 | 9.8 | 9.4 | 9.1 | 10.2 | 10.4 | 11.5 | 11.1 | 10.5 | 9.6 | 11.3 | 10.2 |
| Khmelnytskyi | 9.6 | 9.8 | 9.4 | 8.7 | 9.9 | 10.4 | 9.7 | 8.9 | 8.8 | 7.9 | 9.8 | 9.4 |
| Kirovohrad | 9.8 | 9.4 | 9.2 | 8.5 | 11.7 | 11.9 | 12.7 | 12.2 | 12.0 | 10.9 | 12.7 | 11.0 |
| Kyiv | 7.9 | 7.2 | 6.7 | 6.4 | 8.1 | 6.5 | 6.9 | 6.5 | 6.4 | 5.9 | 6.9 | 6.9 |
| Luhansk | 7.8 | 7.1 | 6.9 | 6.7 | 11.8 | 16.6 | 16.9 | 16.6 | 16.0 | 13.5 | 15.3 | 12.3 |
| Lviv | 8.4 | 8.3 | 8.0 | 7.5 | 8.8 | 8.3 | 7.9 | 7.5 | 7.0 | 6.5 | 7.5 | 7.8 |
| Mykolaiv | 9.2 | 8.8 | 8.4 | 7.8 | 9.4 | 9.2 | 9.9 | 10.3 | 10.0 | 9.3 | 10.7 | 9.4 |
| Odesa | 6.6 | 6.4 | 6.3 | 5.7 | 7.0 | 6.7 | 6.9 | 7.3 | 6.6 | 5.9 | 7.1 | 6.6 |
| Poltava | 10.5 | 9.9 | 9.2 | 8.7 | 11.8 | 12.4 | 12.9 | 12.0 | 11.5 | 10.6 | 12.0 | 11.0 |
| Rivne | 12.5 | 11.5 | 10.8 | 10.3 | 11.7 | 11.0 | 11.7 | 11.6 | 10.2 | 8.2 | 9.3 | 10.8 |
| Sumy | 11.6 | 10.2 | 9.6 | 8.5 | 10.2 | 10.6 | 9.8 | 9.1 | 9.2 | 7.7 | 9.4 | 9.6 |
| Ternopil | 11.6 | 11.4 | 10.8 | 10.3 | 12.0 | 12.0 | 11.7 | 11.9 | 10.7 | 10.0 | 11.5 | 11.3 |
| Vinnytsia | 11.1 | 10.9 | 9.7 | 9.2 | 11.1 | 9.3 | 10.1 | 10.7 | 10.2 | 9.4 | 10.6 | 10.2 |
| Volyn | 9.3 | 9.1 | 8.8 | 8.4 | 10.3 | 10.0 | 11.7 | 12.5 | 11.6 | 10.6 | 12.4 | 10.4 |
| Zakarpattia | 9.3 | 10.2 | 9.2 | 8.2 | 9.6 | 9.5 | 10.3 | 10.5 | 10.3 | 9.1 | 10.6 | 9.7 |
| Zaporizhzhia | 8.2 | 7.9 | 7.5 | 7.0 | 8.8 | 10.2 | 10.3 | 10.7 | 10.3 | 9.4 | 10.6 | 9.2 |
| Zhytomyr | 11.0 | 11.2 | 10.7 | 10.2 | 12.3 | 12.0 | 11.7 | 10.8 | 10.8 | 9.6 | 10.9 | 11.0 |

Note. *This indicator is an incentive (compiled and calculated according to the State Statistics Service of Ukraine, 2024)

**Table B3.** Wage arrears per employee* by region for 2010-2020 (UAH thousand)

| Region | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cherkasy | 172.0 | 123.8 | 76.2 | 113.5 | 85.9 | 174.5 | 190.8 | 165.8 | 842.8 | 409.4 | 318.6 | 239.4 |
| Chernihiv | 201.8 | 176.1 | 174.7 | 185.6 | 163.6 | 189.7 | 197.0 | 140.7 | 97.1 | 148.0 | 110.6 | 162.6 |
| Chernivtsi | 87.9 | 49.5 | 3.4 | 1.8 | 2.0 | 63.5 | 23.2 | 39.7 | 35.4 | 1.8 | 1.7 | 28.6 |
| City of Kyiv | 88.8 | 73.1 | 47.9 | 53.6 | 24.6 | 61.2 | 47.0 | 47.0 | 59.1 | 83.2 | 114.8 | 64.6 |
| Dnipropetrovsk | 115.8 | 31.4 | 19.5 | 14.2 | 10.3 | 163.7 | 204.9 | 236.9 | 202.6 | 207.6 | 536.6 | 151.5 |
| Donetsk | 290.5 | 259.3 | 223.8 | 203.6 | 249.8 | 2,888.2 | 1,157.2 | 1,003.4 | 1,764.2 | 1,712.1 | 2,124.5 | 737.2 |
| Ivano-Frankivsk | 93.2 | 81.3 | 84.5 | 98.2 | 93.2 | 117.8 | 47.1 | 61.7 | 208.6 | 218.8 | 331.5 | 135.4 |
| Kharkiv | 257.9 | 283.2 | 199.6 | 204.3 | 181.7 | 295.4 | 477.8 | 663.1 | 614.1 | 689.3 | 938.0 | 421.8 |
| Kherson | 209.3 | 164.9 | 224.5 | 190.3 | 130.2 | 194.5 | 188.3 | 119.8 | 88.5 | 340.2 | 261.2 | 193.5 |
| Khmelnytskyi | 185.6 | 154.2 | 147.1 | 130.8 | 90.6 | 81.4 | 55.2 | 18.1 | 52.6 | 108.1 | 43.4 | 99.0 |
| Kirovohrad | 503.7 | 556.0 | 457.9 | 398.7 | 342.4 | 343.3 | 361.3 | 328.9 | 114.6 | 66.9 | 97.1 | 325.1 |
| Kyiv | 107.5 | 72.7 | 28.9 | 3.9 | 421.4 | 384.5 | 374.2 | 405.5 | 414.9 | 431.3 | 444.0 | 273.9 |
| Luhansk | 354.7 | 298.5 | 262.1 | 207.9 | 342.0 | 3,285.4 | 4,904.7 | 4,273.1 | 8,722.1 | 7,766.3 | 6,425.7 | 1,578.4 |
| Lviv | 208.8 | 166.3 | 152.0 | 166.5 | 140.8 | 237.3 | 333.6 | 322.1 | 256.2 | 212.7 | 384.0 | 229.9 |
| Mykolaiv | 256.2 | 402.2 | 387.9 | 286.8 | 376.1 | 362.9 | 464.5 | 733.8 | 894.0 | 806.6 | 307.5 | 471.1 |
| Odesa | 114.3 | 72.0 | 55.3 | 46.9 | 41.9 | 75.8 | 201.7 | 179.8 | 175.7 | 222.7 | 158.8 | 116.2 |
| Poltava | 149.0 | 111.8 | 84.1 | 66.9 | 66.8 | 121.5 | 144.8 | 125.4 | 167.3 | 221.2 | 248.6 | 135.6 |
| Rivne | 153.3 | 84.1 | 26.3 | 15.4 | 10.6 | 111.4 | 155.7 | 65.8 | 610.1 | 267.8 | 43.1 | 141.4 |
| Sumy | 362.3 | 331.8 | 391.0 | 476.5 | 322.9 | 652.5 | 775.9 | 928.2 | 1,080.5 | 2,251.7 | 2,724.2 | 923.3 |
| Ternopil | 153.0 | 96.9 | 93.3 | 86.7 | 86.5 | 74.6 | 63.3 | 84.7 | 58.1 | 150.9 | 300.8 | 117.7 |
| Vinnytsia | 161.2 | 111.7 | 96.7 | 91.0 | 64.7 | 92.7 | 71.0 | 83.6 | 75.9 | 68.8 | 81.0 | 91.4 |
| Volyn | 153.4 | 120.7 | 57.1 | 48.9 | 39.9 | 125.6 | 163.9 | 44.0 | 177.9 | 151.7 | 252.6 | 123.1 |
| Zakarpattia | 131.0 | 135.6 | 152.1 | 126.5 | 104.5 | 53.8 | 76.7 | 38.4 | 30.1 | 36.0 | 43.9 | 86.5 |
| Zaporizhzhia | 180.5 | 164.3 | 158.3 | 180.0 | 150.4 | 230.9 | 229.4 | 267.6 | 502.8 | 726.0 | 377.7 | 279.9 |
| Zhytomyr | 362.0 | 191.3 | 91.5 | 116.3 | 68.8 | 117.2 | 79.0 | 47.5 | 43.6 | 48.8 | 83.7 | 117.7 |

Note. *This indicator is an incentive (compiled and calculated according to the State Statistics Service of Ukraine, 2024)

**Table B4.** Disposable income per capita* by region for 2010-2020 (UAH)

| Region | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cherkasy | 15,769 | 18,246 | 20,718 | 21,633 | 21,761 | 26,970 | 32,327 | 41,854 | 50,600 | 59,626 | 64,852 | 15,769 |
| Chernihiv | 16,625 | 19,465 | 22,770 | 23,600 | 23,093 | 28,440 | 33,231 | 42,501 | 51,213 | 59,972 | 65,815 | 16,625 |
| Chernivtsi | 13,503 | 15,993 | 18,108 | 19,438 | 18,476 | 23,929 | 28,361 | 36,215 | 42,762 | 49,142 | 54,178 | 13,503 |
| City of Kyiv | 37,013 | 42,577 | 52,709 | 55,842 | 62,715 | 76,514 | 92,254 | 118,208 | 143,676 | 173,677 | 182,547 | 37,013 |
| Dnipropetrovsk | 20,739 | 24,302 | 28,772 | 30,301 | 32,036 | 39,142 | 44,366 | 57,333 | 74,755 | 89,042 | 94,804 | 20,739 |
| Donetsk | 21,317 | 24,890 | 29,337 | 31,049 | 26,234 | 21,346 | 20,927 | 25,278 | 33,840 | 39,843 | 42,219 | 21,317 |
| Ivano-Frankivsk | 15,009 | 17,733 | 20,148 | 20,988 | 20,357 | 26,540 | 31,719 | 40,580 | 48,724 | 56,514 | 61,088 | 15,009 |
| Kharkiv | 18,451 | 21,788 | 24,870 | 26,098 | 26,274 | 32,198 | 38,197 | 48,370 | 56,421 | 66,547 | 75,923 | 18,451 |
| Kherson | 14,882 | 17,654 | 19,940 | 21,724 | 20,728 | 27,880 | 32,968 | 41,695 | 50,195 | 58,129 | 63,853 | 14,882 |
| Khmelnytskyi | 15,781 | 18,738 | 21,591 | 22,789 | 22,686 | 29,292 | 34,395 | 43,638 | 50,640 | 58,934 | 65,411 | 15,781 |
| Kirovohrad | 15,418 | 18,039 | 20,554 | 21,671 | 21,954 | 27,383 | 32,745 | 42,227 | 50,373 | 58,461 | 64,510 | 15,418 |
| Kyiv | 19,514 | 22,520 | 26,542 | 27,391 | 28,443 | 33,956 | 40,127 | 50,664 | 65,623 | 76,232 | 80,274 | 19,514 |
| Luhansk | 17,850 | 20,880 | 24,024 | 25,590 | 19,788 | 15,634 | 13,793 | 16,416 | 21,252 | 24,975 | 27,274 | 17,850 |
| Lviv | 16,514 | 19,204 | 21,992 | 23,138 | 23,595 | 29,542 | 35,325 | 44,981 | 56,592 | 67,353 | 73,092 | 16,514 |
| Mykolaiv | 16,993 | 20,041 | 22,878 | 23,869 | 23,459 | 29,342 | 34,971 | 45,356 | 55,469 | 64,700 | 69,884 | 16,993 |
| Odesa | 16,275 | 19,135 | 22,224 | 25,572 | 24,242 | 32,385 | 39,132 | 50,111 | 63,153 | 75,288 | 82,007 | 16,275 |
| Poltava | 17,991 | 20,917 | 24,027 | 25,371 | 26,196 | 31,997 | 37,938 | 48,663 | 61,649 | 72,843 | 78,813 | 17,991 |
| Rivne | 14,630 | 17,326 | 19,860 | 21,165 | 21,781 | 26,708 | 31,295 | 40,325 | 48,184 | 55,917 | 59,350 | 14,630 |
| Sumy | 16,876 | 19,593 | 22,582 | 23,559 | 23,938 | 30,572 | 36,084 | 45,852 | 55,829 | 65,932 | 71,955 | 16,876 |
| Ternopil | 13,824 | 16,351 | 18,561 | 18,994 | 18,401 | 24,040 | 28,195 | 36,204 | 43,577 | 50,536 | 55,776 | 13,824 |
| Vinnytsia | 16,018 | 19,091 | 21,735 | 23,001 | 23,422 | 29,637 | 34,931 | 45,436 | 55,734 | 65,503 | 70,939 | 16,018 |
| Volyn | 14,312 | 16,658 | 18,807 | 19,805 | 20,137 | 24,980 | 30,013 | 38,514 | 46,120 | 53,990 | 57,973 | 14,312 |
| Zakarpattia | 12,700 | 15,002 | 17,191 | 17,929 | 17,358 | 22,457 | 26,856 | 33,891 | 41,418 | 47,852 | 52,379 | 12,700 |
| Zaporizhzhia | 20,221 | 23,685 | 27,108 | 28,388 | 30,182 | 36,277 | 43,462 | 54,261 | 65,065 | 76,062 | 83,309 | 20,221 |
| Zhytomyr | 15,776 | 18,716 | 21,288 | 21,652 | 22,102 | 27,801 | 32,979 | 42,684 | 52,715 | 62,571 | 66,651 | 15,776 |

Note. *This indicator is an incentive (compiled and calculated according to the State Statistics Service of Ukraine, 2024)

**Table B5.** Wages and salaries per employee* by region for 2010-2020 (UAH thousand)

| Region | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cherkasy | 18.9 | 22.6 | 27.4 | 29.2 | 31.9 | 38.7 | 47.9 | 65.9 | 81.9 | 96.8 | 108.2 | 51.1 |
| Chernihiv | 16.4 | 20.0 | 23.9 | 26.3 | 29.5 | 38.5 | 47.0 | 63.5 | 79.1 | 90.1 | 104.0 | 48.5 |
| Chernivtsi | 15.9 | 20.0 | 23.1 | 24.1 | 25.9 | 32.9 | 40.2 | 54.9 | 67.5 | 80.5 | 85.7 | 42.3 |
| City of Kyiv | 32.3 | 38.4 | 47.8 | 49.7 | 52.9 | 67.4 | 82.3 | 106.4 | 131.7 | 153.4 | 165.4 | 86.7 |
| Dnipropetrovsk | 27.0 | 31.9 | 37.6 | 38.7 | 43.9 | 53.0 | 60.2 | 79.7 | 102.6 | 124.0 | 132.3 | 64.6 |
| Donetsk | 30.3 | 37.3 | 44.2 | 46.7 | 61.0 | 60.6 | 81.4 | 102.1 | 121.0 | 143.4 | 154.7 | 61.6 |
| Ivano-Frankivsk | 16.7 | 21.0 | 25.4 | 26.1 | 28.7 | 36.3 | 46.4 | 66.6 | 80.2 | 91.9 | 103.0 | 50.6 |
| Kharkiv | 21.4 | 25.7 | 30.6 | 33.0 | 35.4 | 42.3 | 47.7 | 64.5 | 79.8 | 93.4 | 104.0 | 50.9 |
| Kherson | 16.5 | 19.8 | 23.4 | 24.7 | 26.6 | 33.6 | 42.9 | 57.7 | 71.0 | 84.0 | 96.7 | 43.8 |
| Khmelnytskyi | 16.5 | 20.5 | 25.1 | 26.8 | 30.4 | 36.9 | 44.3 | 63.2 | 78.6 | 88.9 | 101.2 | 48.7 |
| Kirovohrad | 16.4 | 20.1 | 24.2 | 26.5 | 28.6 | 34.8 | 43.1 | 59.8 | 75.0 | 87.7 | 99.1 | 47.0 |
| Kyiv | 25.8 | 32.3 | 37.5 | 38.8 | 41.2 | 52.4 | 66.0 | 86.2 | 106.4 | 132.0 | 141.3 | 67.7 |
| Luhansk | 26.2 | 33.7 | 39.4 | 41.0 | 48.0 | 45.4 | 54.9 | 55.1 | 76.9 | 94.6 | 104.9 | 43.9 |
| Lviv | 21.1 | 26.0 | 30.1 | 32.0 | 34.8 | 43.7 | 53.3 | 71.1 | 86.3 | 99.7 | 107.3 | 53.9 |
| Mykolaiv | 20.8 | 26.0 | 31.7 | 34.0 | 37.7 | 47.0 | 56.0 | 73.0 | 86.3 | 100.9 | 118.5 | 56.3 |
| Odesa | 22.2 | 27.2 | 32.6 | 33.8 | 36.9 | 46.4 | 54.1 | 70.0 | 82.8 | 95.8 | 105.3 | 52.6 |
| Poltava | 22.2 | 26.7 | 32.0 | 34.2 | 36.5 | 44.6 | 55.4 | 77.3 | 99.9 | 109.0 | 120.4 | 58.8 |
| Rivne | 18.0 | 22.2 | 26.3 | 28.2 | 31.3 | 38.0 | 46.4 | 61.3 | 74.4 | 88.7 | 98.2 | 48.9 |
| Sumy | 19.1 | 23.6 | 28.9 | 31.5 | 33.7 | 42.9 | 52.8 | 69.9 | 87.6 | 95.9 | 112.2 | 53.2 |
| Ternopil | 14.6 | 20.0 | 23.9 | 25.7 | 28.4 | 36.2 | 42.9 | 61.1 | 77.8 | 93.4 | 106.9 | 48.9 |
| Vinnytsia | 17.6 | 21.9 | 26.1 | 28.6 | 31.3 | 39.7 | 49.9 | 70.3 | 87.6 | 103.4 | 116.3 | 54.4 |
| Volyn | 16.2 | 20.7 | 24.8 | 26.4 | 30.3 | 39.0 | 49.4 | 67.2 | 81.3 | 96.0 | 104.1 | 50.8 |
| Zakarpattia | 17.4 | 20.4 | 23.6 | 25.8 | 29.7 | 40.5 | 53.3 | 75.4 | 95.5 | 104.9 | 110.2 | 53.5 |
| Zaporizhzhia | 22.9 | 28.3 | 34.0 | 35.1 | 39.6 | 49.7 | 59.8 | 77.3 | 99.1 | 115.8 | 124.5 | 60.2 |
| Zhytomyr | 17.3 | 21.4 | 25.2 | 27.2 | 30.9 | 37.8 | 48.7 | 66.1 | 82.1 | 96.1 | 107.0 | 51.1 |

Note. *This indicator is an incentive (compiled and calculated according to the State Statistics Service of Ukraine, 2024)

# APPENDIX C

**Table C1.** Capital investments on environmental protection per enterprise* by region for 2010-2020 (UAH thousand)

| Region | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cherkasy | 4.949 | 3.114 | 2.748 | 3.677 | 2.228 | 6.547 | 8.298 | 2.539 | 2.516 | 3.408 | 4.619 | 4.041 |
| Chernihiv | 5.241 | 8.485 | 7.443 | 8.332 | 4.068 | 5.130 | 4.395 | 8.034 | 10.528 | 7.719 | 7.908 | 7.083 |
| Chernivtsi | 1.590 | 4.712 | 1.947 | 0.928 | 0.884 | 4.622 | 3.943 | 6.053 | 5.227 | 7.110 | 19.011 | 5.058 |
| City of Kyiv | 0.553 | 2.939 | 4.765 | 2.344 | 5.698 | 5.619 | 9.290 | 10.981 | 15.453 | 11.349 | 11.131 | 7.421 |
| Dnipropetrovsk | 34.727 | 56.198 | 36.057 | 35.495 | 57.390 | 52.033 | 64.973 | 94.248 | 84.299 | 82.208 | 165.565 | 70.754 |
| Donetsk | 20.997 | 35.146 | 32.519 | 51.114 | 32.969 | 19.745 | 62.090 | 74.128 | 155.610 | 251.392 | 327.166 | 70.773 |
| Ivano-Frankivsk | 17.870 | 13.885 | 7.186 | 11.174 | 17.588 | 11.402 | 17.389 | 48.484 | 35.370 | 28.912 | 32.938 | 22.193 |
| Kharkiv | 3.824 | 20.532 | 24.357 | 6.769 | 2.803 | 2.522 | 4.657 | 15.079 | 11.476 | 18.873 | 28.112 | 12.744 |
| Kherson | 0.393 | 0.517 | 0.274 | 0.983 | 0.826 | 0.982 | 0.318 | 0.396 | 1.861 | 0.864 | 1.360 | 0.816 |
| Khmelnytskyi | 0.672 | 0.601 | 2.112 | 1.468 | 0.978 | 2.754 | 5.896 | 5.157 | 10.679 | 9.013 | 7.968 | 4.473 |
| Kirovohrad | 3.887 | 1.117 | 1.989 | 1.205 | 3.169 | 0.814 | 2.570 | 1.833 | 5.128 | 8.824 | 5.669 | 3.438 |
| Kyiv | 3.503 | 84.737 | 111.477 | 99.772 | 212.030 | 228.887 | 466.252 | 211.413 | 88.443 | 329.540 | 14.046 | 170.890 |
| Luhansk | 9.401 | 14.955 | 48.398 | 28.279 | 67.179 | 15.465 | 11.124 | 3.947 | 8.508 | 4.699 | 12.756 | 22.306 |
| Lviv | 4.306 | 5.818 | 3.695 | 7.814 | 7.061 | 3.242 | 6.671 | 13.463 | 14.793 | 10.804 | 7.897 | 7.841 |
| Mykolaiv | 2.784 | 6.691 | 6.176 | 3.106 | 4.961 | 9.288 | 12.210 | 10.931 | 12.068 | 10.113 | 28.866 | 9.927 |
| Odesa | 2.219 | 3.488 | 1.290 | 1.368 | 0.409 | 1.110 | 0.835 | 3.958 | 2.981 | 2.607 | 4.900 | 2.312 |
| Poltava | 8.062 | 7.228 | 12.558 | 13.292 | 12.767 | 6.599 | 11.463 | 19.596 | 24.101 | 25.814 | 32.819 | 16.308 |
| Rivne | 4.048 | 2.564 | 5.241 | 9.014 | 3.756 | 8.171 | 6.422 | 7.482 | 7.051 | 6.079 | 8.508 | 6.276 |
| Sumy | 2.855 | 4.362 | 2.748 | 2.539 | 2.551 | 8.988 | 9.192 | 8.261 | 3.822 | 3.760 | 14.097 | 5.778 |
| Ternopil | 1.613 | 1.339 | 0.960 | 0.798 | 0.830 | 4.659 | 12.941 | 6.877 | 3.854 | 4.978 | 7.050 | 4.047 |
| Vinnytsia | 4.634 | 7.681 | 3.576 | 3.147 | 0.785 | 4.293 | 7.365 | 9.671 | 8.334 | 5.811 | 18.460 | 6.788 |
| Volyn | 0.678 | 6.993 | 1.331 | 0.536 | 0.615 | 0.941 | 2.108 | 3.442 | 5.887 | 5.732 | 5.398 | 3.120 |
| Zakarpattia | 1.705 | 1.514 | 2.128 | 1.317 | 0.892 | 1.278 | 1.169 | 2.391 | 7.142 | 2.200 | 3.721 | 2.380 |
| Zaporizhzhia | 10.916 | 27.826 | 31.700 | 21.852 | 60.848 | 41.012 | 78.874 | 56.059 | 71.056 | 69.226 | 58.754 | 48.001 |
| Zhytomyr | 1.818 | 1.654 | 0.769 | 0.106 | 3.834 | 2.721 | 2.821 | 2.253 | 1.191 | 0.940 | 1.681 | 1.782 |

Note. *This indicator is an incentive (compiled and calculated according to the State Statistics Service of Ukraine, 2024)

**Table C2.** Current expenditures on environmental protection per enterprise* by region for 2010-2020 (UAH thousand)

| Region | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cherkasy | 8.490 | 9.021 | 22.539 | 19.722 | 25.182 | 24.826 | 24.793 | 28.669 | 36.057 | 36.519 | 28.116 | 24.770 |
| Chernihiv | 33.629 | 37.089 | 32.729 | 26.844 | 33.021 | 36.396 | 44.948 | 48.363 | 63.662 | 54.707 | 62.574 | 43.369 |
| Chernivtsi | 8.003 | 12.606 | 12.944 | 13.470 | 14.789 | 16.976 | 20.047 | 22.150 | 24.748 | 28.825 | 38.684 | 19.202 |
| City of Kyiv | 5.059 | 6.970 | 12.759 | 13.488 | 14.390 | 16.974 | 28.870 | 25.952 | 35.300 | 35.772 | 36.635 | 21.558 |
| Dnipropetrovsk | 88.827 | 118.698 | 150.524 | 141.475 | 193.300 | 201.616 | 214.263 | 198.390 | 241.201 | 266.561 | 296.561 | 194.182 |
| Donetsk | 59.347 | 70.501 | 82.214 | 80.696 | 101.121 | 121.696 | 195.988 | 177.279 | 220.510 | 228.466 | 262.035 | 116.583 |
| Ivano-Frankivsk | 19.372 | 29.453 | 29.213 | 25.496 | 23.503 | 29.459 | 36.718 | 41.397 | 66.181 | 73.712 | 72.219 | 41.213 |
| Kharkiv | 20.429 | 17.956 | 20.917 | 28.749 | 25.606 | 31.592 | 40.244 | 39.830 | 44.259 | 49.331 | 53.094 | 33.527 |
| Kherson | 8.421 | 13.435 | 10.650 | 7.799 | 7.697 | 8.950 | 10.322 | 9.635 | 10.773 | 11.833 | 22.396 | 11.089 |
| Khmelnytskyi | 16.373 | 15.527 | 19.561 | 21.245 | 23.033 | 27.557 | 29.005 | 30.323 | 34.484 | 40.556 | 41.714 | 27.724 |
| Kirovohrad | 12.893 | 8.025 | 7.571 | 10.944 | 10.588 | 14.755 | 15.795 | 18.145 | 19.442 | 20.989 | 24.077 | 15.212 |
| Kyiv | 15.692 | 18.971 | 20.475 | 21.881 | 23.962 | 26.939 | 33.715 | 45.487 | 38.227 | 45.786 | 55.257 | 32.442 |
| Luhansk | 119.739 | 102.550 | 107.214 | 92.593 | 164.939 | 155.576 | 172.682 | 145.745 | 117.939 | 121.211 | 137.690 | 119.278 |
| Lviv | 7.524 | 11.011 | 12.793 | 12.307 | 13.973 | 18.345 | 24.603 | 24.902 | 30.634 | 25.432 | 28.997 | 19.256 |
| Mykolaiv | 48.699 | 58.423 | 22.795 | 27.136 | 71.611 | 142.163 | 135.192 | 133.940 | 65.471 | 75.158 | 56.291 | 75.939 |
| Odesa | 13.325 | 10.288 | 8.754 | 10.083 | 8.703 | 11.695 | 24.744 | 32.403 | 22.063 | 15.273 | 31.347 | 17.074 |
| Poltava | 49.659 | 54.418 | 64.436 | 64.073 | 64.117 | 84.288 | 101.684 | 104.611 | 131.849 | 129.867 | 98.749 | 87.391 |
| Rivne | 38.654 | 48.167 | 54.431 | 51.299 | 52.980 | 64.814 | 70.121 | 65.112 | 66.100 | 88.998 | 86.113 | 63.238 |
| Sumy | 27.665 | 40.064 | 35.279 | 30.679 | 30.355 | 43.054 | 58.265 | 79.930 | 123.879 | 104.772 | 103.013 | 62.650 |
| Ternopil | 3.608 | 2.907 | 4.098 | 3.506 | 2.922 | 2.775 | 3.026 | 2.686 | 3.505 | 3.891 | 7.089 | 3.655 |
| Vinnytsia | 9.458 | 12.569 | 8.849 | 12.927 | 12.702 | 15.601 | 20.831 | 23.602 | 27.674 | 29.895 | 22.180 | 18.220 |
| Volyn | 9.495 | 12.471 | 12.127 | 12.237 | 12.996 | 19.396 | 22.662 | 30.521 | 40.337 | 45.493 | 48.863 | 25.107 |
| Zakarpattia | 7.941 | 9.819 | 9.831 | 7.050 | 11.727 | 14.528 | 25.526 | 28.363 | 35.211 | 42.031 | 38.947 | 21.456 |
| Zaporizhzhia | 52.532 | 64.164 | 82.051 | 82.057 | 88.013 | 110.039 | 137.270 | 137.416 | 166.485 | 183.975 | 157.135 | 115.215 |
| Zhytomyr | 9.327 | 10.766 | 9.144 | 9.160 | 11.635 | 12.984 | 17.421 | 18.013 | 20.465 | 24.853 | 28.951 | 15.957 |

Note. *This indicator is an incentive (compiled and calculated according to the State Statistics Service of Ukraine, 2024)

**Table C3.** Air emissions total from stational pollution sources per capita* by region for 2010-2020 (kg)

| Region | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cherkasy | 47.6 | 48.7 | 54.7 | 58.0 | 53.3 | 46.3 | 42.5 | 39.6 | 48.0 | 43.5 | 43.6 | 47.9 |
| Chernihiv | 43.2 | 45.5 | 42.5 | 41.0 | 39.7 | 32.4 | 35.9 | 31.0 | 29.5 | 27.7 | 21.4 | 35.7 |
| Chernivtsi | 4.2 | 4.2 | 3.2 | 3.0 | 2.7 | 3.5 | 3.3 | 3.6 | 3.0 | 2.7 | 2.0 | 3.2 |
| City of Kyiv | 10.2 | 11.8 | 11.6 | 11.1 | 10.9 | 9.2 | 11.7 | 15.5 | 9.9 | 7.5 | 8.6 | 10.7 |
| Dnipropetrovsk | 279.7 | 286.2 | 290.8 | 285.7 | 261.2 | 222.4 | 257.9 | 203.4 | 191.6 | 181.6 | 170.2 | 239.9 |
| Donetsk | 310.9 | 346.5 | 346.2 | 333.4 | 242.7 | 215.1 | 231.2 | 186.8 | 189.7 | 187.2 | 183.2 | 253.6 |
| Ivano-Frankivsk | 122.6 | 160.7 | 142.4 | 146.8 | 165.5 | 162.0 | 142.5 | 144.0 | 161.2 | 149.8 | 103.2 | 145.6 |
| Kharkiv | 55.1 | 63.5 | 72.0 | 76.8 | 55.1 | 19.6 | 37.1 | 16.7 | 16.7 | 40.1 | 35.7 | 44.6 |
| Kherson | 4.9 | 5.4 | 5.9 | 5.6 | 6.7 | 8.4 | 9.2 | 9.2 | 12.0 | 17.3 | 17.5 | 9.2 |
| Khmelnytskyi | 14.4 | 14.2 | 12.5 | 13.2 | 13.1 | 14.1 | 16.9 | 16.6 | 17.5 | 16.2 | 14.6 | 14.8 |
| Kirovohrad | 14.7 | 15.2 | 16.9 | 15.9 | 12.0 | 14.6 | 12.2 | 12.8 | 12.9 | 13.7 | 11.6 | 13.9 |
| Kyiv | 62.2 | 66.1 | 75.1 | 64.9 | 55.6 | 45.1 | 56.6 | 27.5 | 46.0 | 47.4 | 37.2 | 52.9 |
| Luhansk | 223.3 | 207.7 | 198.4 | 197.4 | 89.1 | 52.2 | 70.8 | 34.6 | 21.7 | 17.5 | 16.7 | 104.6 |
| Lviv | 44.5 | 50.9 | 51.4 | 47.8 | 39.5 | 40.4 | 40.7 | 43.1 | 42.3 | 35.4 | 30.4 | 42.4 |
| Mykolaiv | 18.2 | 21.8 | 21.4 | 17.5 | 13.7 | 13.6 | 12.1 | 12.4 | 11.6 | 10.8 | 10.1 | 14.9 |
| Odesa | 12.2 | 12.8 | 11.8 | 10.9 | 9.7 | 10.9 | 11.1 | 12.4 | 15.7 | 13.9 | 18.0 | 12.7 |
| Poltava | 48.9 | 48.9 | 46.3 | 45.7 | 43.4 | 38.6 | 39.4 | 39.5 | 37.2 | 36.8 | 33.4 | 41.8 |
| Rivne | 11.2 | 14.8 | 12.9 | 10.4 | 10.0 | 8.8 | 7.8 | 8.3 | 7.9 | 8.6 | 8.8 | 9.9 |
| Sumy | 27.3 | 31.2 | 26.4 | 26.9 | 24.0 | 15.7 | 17.9 | 18.6 | 19.2 | 20.3 | 19.8 | 22.6 |
| Ternopil | 17.1 | 18.9 | 19.4 | 14.8 | 7.7 | 8.0 | 8.5 | 10.1 | 9.8 | 9.0 | 9.2 | 12.1 |
| Vinnytsia | 62.8 | 53.4 | 62.3 | 92.4 | 77.3 | 84.1 | 75.3 | 98.9 | 62.4 | 64.5 | 51.1 | 71.4 |
| Volyn | 7.9 | 7.3 | 7.0 | 6.3 | 4.1 | 4.5 | 4.5 | 4.9 | 4.9 | 5.1 | 5.0 | 5.6 |
| Zakarpattia | 13.9 | 13.8 | 6.5 | 6.1 | 3.1 | 3.5 | 3.9 | 2.5 | 3.2 | 3.0 | 2.6 | 5.6 |
| Zaporizhzhia | 120.7 | 128.0 | 116.3 | 138.5 | 117.1 | 110.5 | 96.0 | 105.0 | 102.4 | 102.8 | 93.3 | 112.1 |
| Zhytomyr | 14.4 | 14.9 | 14.6 | 13.6 | 8.7 | 7.2 | 7.5 | 8.4 | 10.7 | 10.5 | 9.9 | 11.0 |

Note. *This indicator is an incentive (compiled and calculated according to the State Statistics Service of Ukraine, 2024)

**Table C4.** Carbon dioxide emissions from stational pollution per capita* by region for 2010-2020 (kg)

| Region | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cherkasy | 2,487 | 2,572 | 2,621 | 2,156 | 2,124 | 2,142 | 2,347 | 1,985 | 2,231 | 2,195 | 2,033 | 2,267 |
| Chernihiv | 1,716 | 1,784 | 1,728 | 1,687 | 1,588 | 1,452 | 1,639 | 1,596 | 1,669 | 1,556 | 1,399 | 1,622 |
| Chernivtsi | 248 | 227 | 200 | 179 | 151 | 170 | 166 | 163 | 181 | 158 | 156 | 182 |
| City of Kyiv | 2,484 | 2,500 | 2,490 | 2,266 | 1,956 | 1,763 | 1,933 | 1,833 | 1,820 | 1,785 | 1,547 | 2,028 |
| Dnipropetrovsk | 5,642 | 10,236 | 10,452 | 9,896 | 10,047 | 7,878 | 9,594 | 8,069 | 7,367 | 7,397 | 6,516 | 8,475 |
| Donetsk | 13,312 | 14,451 | 13,870 | 13,823 | 9,862 | 8,440 | 8,996 | 5,447 | 6,036 | 5,694 | 5,428 | 9,662 |
| Ivano-Frankivsk | 5,191 | 7,443 | 8,218 | 7,992 | 8,154 | 8,374 | 8,165 | 8,686 | 10,022 | 9,428 | 7,499 | 8,105 |
| Kharkiv | 3,786 | 4,571 | 4,283 | 4,332 | 3,531 | 1,974 | 2,665 | 2,140 | 2,721 | 2,857 | 2,958 | 3,263 |
| Kherson | 361 | 341 | 354 | 349 | 328 | 332 | 323 | 305 | 312 | 303 | 324 | 330 |
| Khmelnytskyi | 1,616 | 1,682 | 1,488 | 1,607 | 1,673 | 1,694 | 1,861 | 1,826 | 1,747 | 1,787 | 1,846 | 1,710 |
| Kirovohrad | 832 | 959 | 915 | 958 | 982 | 1,040 | 1,053 | 1,131 | 1,185 | 992 | 922 | 996 |
| Kyiv | 4,861 | 4,141 | 4,269 | 3,796 | 3,323 | 2,674 | 2,898 | 1,738 | 2,318 | 2,686 | 2,057 | 3,150 |
| Luhansk | 4,717 | 9,287 | 9,021 | 9,559 | 7,124 | 2,970 | 4,462 | 1,958 | 1,476 | 1,125 | 953 | 4,851 |
| Lviv | 867 | 1,200 | 1,451 | 1,519 | 1,323 | 1,341 | 1,373 | 1,536 | 1,528 | 1,354 | 1,188 | 1,335 |
| Mykolaiv | 1,421 | 1,680 | 1,789 | 1,790 | 1,608 | 1,568 | 1,797 | 1,857 | 1,793 | 1,920 | 1,888 | 1,735 |
| Odesa | 1,439 | 1,418 | 1,279 | 1,468 | 1,264 | 1,352 | 879 | 758 | 588 | 500 | 667 | 1,057 |
| Poltava | 1,533 | 1,789 | 1,666 | 2,067 | 2,321 | 2,304 | 2,405 | 2,513 | 2,386 | 1,421 | 1,159 | 1,961 |
| Rivne | 834 | 1,367 | 1,209 | 1,035 | 1,113 | 1,072 | 1,116 | 1,235 | 1,174 | 1,810 | 1,804 | 1,251 |
| Sumy | 1,417 | 1,563 | 1,365 | 1,446 | 1,344 | 1,118 | 1,451 | 1,532 | 1,678 | 1,486 | 1,230 | 1,421 |
| Ternopil | 749 | 678 | 545 | 581 | 488 | 342 | 384 | 581 | 536 | 647 | 473 | 546 |
| Vinnytsia | 2,977 | 2,815 | 3,381 | 4,351 | 3,957 | 4,033 | 3,201 | 4,037 | 3,403 | 3,465 | 2,779 | 3,492 |
| Volyn | 592 | 698 | 695 | 543 | 448 | 427 | 455 | 502 | 493 | 453 | 449 | 523 |
| Zakarpattia | 192 | 301 | 162 | 170 | 102 | 106 | 115 | 174 | 141 | 210 | 155 | 166 |
| Zaporizhzhia | 7,528 | 7,849 | 7,040 | 7,461 | 7,349 | 7,927 | 7,607 | 8,152 | 8,567 | 8,097 | 7,788 | 7,755 |
| Zhytomyr | 601 | 575 | 632 | 585 | 516 | 474 | 529 | 571 | 630 | 573 | 603 | 572 |

Note. *This indicator is an incentive (compiled and calculated according to the State Statistics Service of Ukraine, 2024)

**Table C5.** Recycled waste per capita* by region for 2010-2020 (kg)

| Region | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cherkasy | 763 | 958 | 755 | 622 | 558 | 579 | 567 | 628 | 653 | 585 | 538 | 657.2 |
| Chernihiv | 76 | 80 | 96 | 219 | 102 | 128 | 101 | 128 | 109 | 70 | 75 | 107.7 |
| Chernivtsi | 36 | 53 | 130 | 100 | 61 | 76 | 133 | 123 | 101 | 130 | 92 | 94.2 |
| City of Kyiv | 5.5 | 2.1 | 1.0 | 0.5 | 4.5 | 0.1 | 0.6 | 3.1 | 0.7 | 0.3 | 43.4 | 5.7 |
| Dnipropetrovsk | 28,256 | 28,190 | 28,648 | 31,040 | 25,617 | 21,966 | 20,662 | 25,936 | 26,526 | 28,481 | 27,731 | 26,651.9 |
| Donetsk | 3,857 | 4,509 | 3,014 | 2,531 | 60 | 637 | 885 | 1,285 | 1,601 | 1,309 | 1,137 | 1,916.7 |
| Ivano-Frankivsk | 439 | 271 | 384 | 377 | 308 | 416 | 494 | 473 | 403 | 636 | 386 | 416.8 |
| Kharkiv | 191 | 108 | 117 | 103 | 74 | 104 | 156 | 45 | 107 | 73 | 94 | 106.8 |
| Kherson | 71 | 103 | 69 | 88 | 84 | 62 | 22 | 30 | 32 | 27 | 24 | 56.2 |
| Khmelnytskyi | 196 | 219 | 401 | 377 | 234 | 267 | 350 | 312 | 396 | 319 | 329 | 308.5 |
| Kirovohrad | 20,608 | 23,784 | 18,729 | 18,522 | 11,560 | 8,828 | 3,158 | 1,539 | 1,961 | 1,818 | 85 | 10,278.1 |
| Kyiv | 755 | 554 | 332 | 311 | 55 | 73 | 31 | 12 | 19 | 5 | 10 | 193.7 |
| Luhansk | 1,645 | 2,785 | 2,215 | 2,369 | 447 | 120 | 256 | 42 | 21 | 20 | 19 | 925.0 |
| Lviv | 19 | 73 | 67 | 65 | 210 | 129 | 190 | 238 | 141 | 130 | 161 | 129.3 |
| Mykolaiv | 100 | 120 | 99 | 96 | 67 | 66 | 70 | 54 | 54 | 55 | 80 | 78.5 |
| Odesa | 158 | 51 | 20 | 11 | 5 | 4 | 4 | 4 | 4 | 1 | 1 | 23.9 |
| Poltava | 1,464 | 2,008 | 3,053 | 2,994 | 2,375 | 2,129 | 2,534 | 1,967 | 1,979 | 2,210 | 1,499 | 2,204.5 |
| Rivne | 104 | 126 | 145 | 49 | 84 | 81 | 56 | 20 | 20 | 34 | 13 | 66.7 |
| Sumy | 292 | 398 | 352 | 224 | 218 | 169 | 176 | 209 | 183 | 147 | 132 | 229.2 |
| Ternopil | 138 | 119 | 189 | 182 | 260 | 132 | 78 | 94 | 230 | 267 | 65 | 159.6 |
| Vinnytsia | 281 | 216 | 526 | 139 | 149 | 230 | 216 | 222 | 309 | 135 | 94 | 229.8 |
| Volyn | 10 | 38 | 54 | 75 | 93 | 101 | 114 | 108 | 115 | 35 | 34 | 70.7 |
| Zakarpattia | 10.4 | 9.4 | 5.7 | 4.5 | 44.1 | 0.7 | 0.2 | 0.2 | 0.3 | 0.2 | 0.2 | 6.9 |
| Zaporizhzhia | 929 | 949 | 945 | 754 | 919 | 1,496 | 1,660 | 1,570 | 1,950 | 2,245 | 2,092 | 1,398.1 |
| Zhytomyr | 125 | 79 | 96 | 71 | 73 | 64 | 62 | 67 | 40 | 44 | 28 | 68.6 |

Note. *This indicator is an incentive (compiled and calculated according to the State Statistics Service of Ukraine, 2024)